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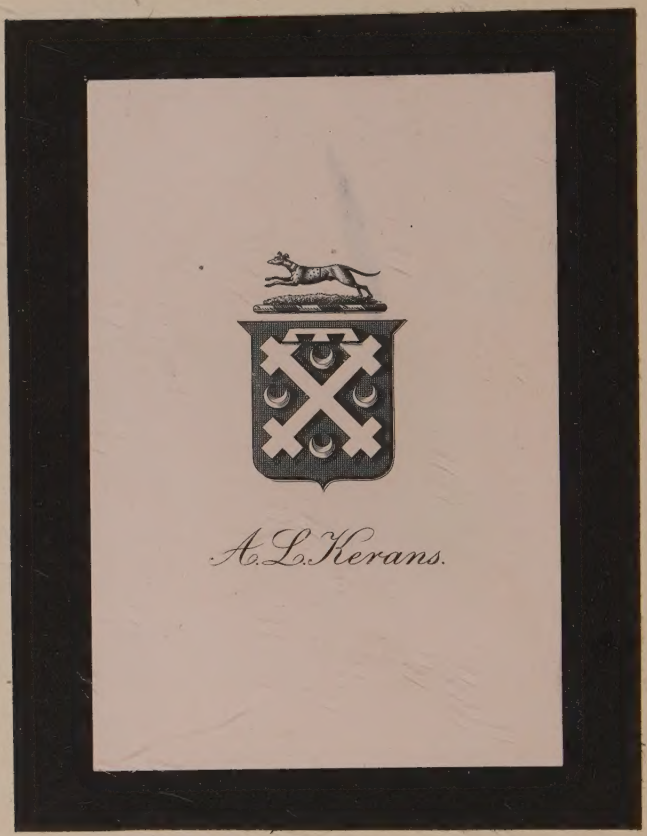

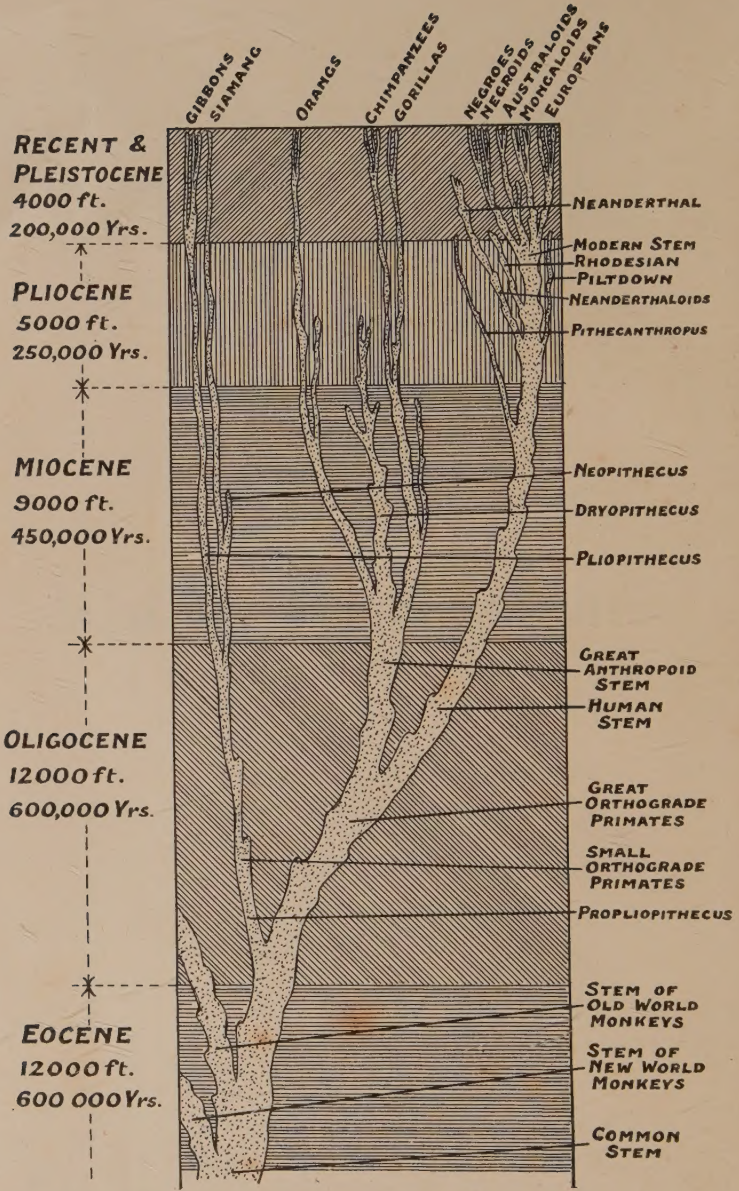

Genealogical tree, showing the ancestral stems and probable lines of descent of the higher primates.

THE ANTIQUITY OF MAN

BY

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PREFACE TO SECOND EDITION

Concerning the Garden of Eden.—The Garden of Eden has often been described before. Long ago an account of it appeared in the Pentateuch; quite lately it has been redescribed in *Back to Methuselah*. The story as told here takes the reader, not to a single sunlit idyllic glade, as in former descriptions, but to dank and dark caves, gravel pits, limestone quarries, excavations for new docks, and even to trenches cut for sewage pipes, all the world over. For in reality the Garden of Eden was world wide. Even England was part of it—apparently an important part. So were the continent of Europe and the ancient lands of Egypt and Mesopotamia. Our search shows that it extended to the most distant lands of Africa, Australia, Asia, and America. Nor was the drama of the Garden enacted in a single morning; it has been going on for a million of years and is still unfinished. There have been many scenes, and we can see no sign of the curtain being rung down on the last of them. The drama of man's evolution—or his "creative evolution," as Mr Shaw insists on naming it—was not staged in a favoured meadow for a single performance; it is still proceeding in our slums, country cottages, and palaces, just as it did in the days when man's only roof was the wide dome of the sky.

Concerning Crete, Egypt, and Mesopotamia.—Fully ten years ago the writer of this book made the round of the haunts of ancient man, and in his first edition described what he saw and what he thought concerning such things as were to be seen. Much has happened since then. On

again making a tour of the world—strictly in a metaphorical sense—for the preparation of the present edition, it became evident that many new chapters would have to be added and many of the old ones recast. As readers of the former edition will remember, our survey of the evidence relating to man's antiquity begins in England during the Neolithic period. We are at once beyond the reach of written history, but the growing recognition that what the people of England thought and did then was influenced by cultural eddies which travelled slowly westwards from Crete, Egypt, and Mesopotamia now makes it possible for us to fix approximate dates for what was done in prehistoric England. For this reason I have found it necessary to introduce in the present edition a chapter in which an attempt has been made to summarise the evidence relating to man's antiquity in these Eastern lands, and at the same time to note the kinds of men who occupied them in early days. I was the more willing to add such a chapter, not only because our modern city civilisation has its roots in these lands, but for another reason. Like other anthropologists, I am interested in the abstract problem of man's origin and antiquity, but am more directly concerned with the concrete question of the origin and antiquity of men of our own type. Where and when did the European kind of man come into existence? All indications point to the East as his evolutionary cradle, but so far the oldest human remains found in Egypt and Mesopotamia are of people who differ from the present inhabitants of these lands in matters of detail only.

Discoveries in England and France.—In England during these last ten years many things have happened which alter our outlook on ancient man. To the list of crania of Palæolithic Englishmen I have had to add three found in a cave in the Mendips by the enthusiastic members

of the Speleological Society of Bristol University, and one from Baker's Hole on the Thames, near Gravesend, entrusted to me for examination by Mr Martin A. C. Hinton. These bear out the conclusion reached in the last edition, that men with long, narrow heads lived in England long before the dawn of the Neolithic period. In France many discoveries have been made regarding the artistic ability and technical skill of prehistoric man, but the one which most concerns us here was made at Solutré, where in strata of Aurignacian date MM. Depéret, Avelin, and Mayet unearthed the skulls of a round-headed people, the oldest of this type hitherto discovered in Europe. I have also found it necessary to give a somewhat full description of the Chancelade man whose skull and skeleton are preserved in the Perigord Museum, Périgueux. He was a man of peculiar parts, some of them being of an Eskimo-like nature, and on this slight basis the eminent geologist, Professor Sollas, has founded a theory that in late glacial times Europe was inhabited by a Mongolian race.

Discoveries in Germany.—In Germany there have been several discoveries of importance. The one which is of greatest interest to anthropologists is that made at Obercassel, near Bonn, where contemporaries of the Chancelade man have been found. They were rugged examples of the Nordic type—the type which is to be seen to-day in Scandinavia. Then at Ehringsdorf, near Weimar, there have come to light fossil remains of a breed of Neanderthal man, belonging to an older time than the Neanderthal men of France, but later than the more primitive Neanderthaloid of Heidelberg. It does now seem probable that Europe was inhabited by men of the Neanderthal stock throughout the greater part of the Pleistocene period—right from the beginning of this period to the end of Mousterian times—and that this

species of man passed through the later stages of his evolution on the continent which became the death-bed of his type. We find the work-floors of Neanderthal man plentifully in England, but so far not a single fossil bone which can be assigned to his body has rewarded an ever-constant search.

Discoveries in Malta, South Africa, and Rhodesia.—In this edition, too, I have given more attention to the human skulls found in the cave at Ofnet, Bavaria, and to those found in the mammoth stratum at Prêdmost, in Moravia. But the discoveries which required the fullest treatment were made on and beyond the bounds of the continent of Europe. The conditions found in Ghar Dalam cave, Malta, throw, I think, a new and strange light on the ways of ancient man. South Africa, as was expected by those who had studied the antiquity of its stone implements, begins to rival Europe as a scene of prehistoric discovery. When preparing the first edition, news came of the discovery of human fossil remains at Boskop in the Transvaal. Since then we have learned much concerning the big-brained Boskop type of South Africa, particularly from announcements made by Mr Fitzsimons and Professor Raymond Dart—more than enough to compress within the limits of a chapter. The most startling revelation of all was that which came from the Broken Hill cave, Rhodesia, towards the end of 1921. Here anthropologists were presented with a fossil skull, primitive in many respects beyond any known to them and yet not unlike what followers of Darwin had expected to find. So important are the bearings of the Rhodesian discovery on our conception of man's evolution that I have devoted two chapters to its elucidation.

Discoveries in Australia, Java, and America.—Then from Australia has come a significant addition to our knowledge of modern man's early history. The fossil

skull from Talgai, Queensland, tells plainly of the settlement of a sea-girt continent at a remote period by men of the modern type. It also revealed the fact that evolution has not left untouched the aborigines of Australia since Pleistocene times. Professor Dubois, the discoverer of Pithecanthropus, has published an account of a remarkable people—the Wadjak race—whose fossil remains he had found in Java, just before his discovery of Pithecanthropus. As I write, there comes from the western frontier of China tidings of fossilised human remains found under circumstances which suggest a great antiquity for them. From time to time newspaper reports have announced discoveries of fossil man in America, both North and South, but all have proved unimportant, with one exception. This exception is the announcement made by Dr Henry Fairfield Osborn, that there existed in North America, about the middle of the Pliocene period, a high form of Anthropoid, one with a decided leaning to the human side, to which he has given the name *Hesperopithecus*. All that is known of this very distant relative of ours are two very imperfect fossil molar teeth. Even those who have faith in Dr Osborn's experience and judgment, and believe in such possibilities as he has announced, regard the evidence as insufficient to return more than an open verdict.

The Antiquity of Modern Man.—These are the chief discoveries which have caused me to increase the size of the present edition. Augmentation, however, is only one of the aspects in which this edition differs from its predecessor; ever-increasing evidence is compelling me to alter my attitude towards many of the major problems of man's evolution. This is particularly the case as regards the antiquity of modern man—the kind of being who makes up all living races—white, yellow, brown, and

black—all of whom have the right, if they have the audacity, to claim the *specific* name of *Homo sapiens*.

One of the reasons which led me to write the first edition of this book was the belief that modern man, particularly his representatives in Europe, was being harshly treated by geologists. If human remains were found in one of the older Pleistocene deposits, and they proved to be modern in size and shape, they were rejected as spurious antiques, no matter what the state of their fossilisation might be. On the other hand, if these remains proved unmodern in character then they were accepted as genuinely old, even if only imperfectly fossilised. It seemed to me then, as it does now, that, in this matter, the geologist's dice was so heavily loaded that it was scarcely possible for modern man to have a fair throw. So I espoused his cause and collected all the cases in which his remains had been found in older Pleistocene strata and believed at the time of their discovery to be as old as the strata in which they were embedded. It was not necessary to prove every instance; it was enough to establish a single case where the geological evidence compelled us to believe that human remains of modern man had been entombed before the opening third of the Pleistocene period was spent. So I selected the case of Galley Hill man. Now, all experts agree that full-blown modern man made his advent in Europe in the latter third of the Pleistocene period. In the opinion of the majority of geologists and anatomists, at the present time, this was his first appearance in Europe. With the evidence of Galley Hill man before me, I held that it was not his first but his second appearance. If he came from somewhere late in the Pleistocene, might he not have come from the same place early in the same period?

I have to confess that as evidence concerning the con-

dition of man in early Pleistocene times accumulates it does not favour my contention. I have expected, during these past ten years, that remains of the modern type of man would be found under circumstances which would prove their early Pleistocene age. No discovery of this kind has been made. Nay, one of the discoveries on which I leaned—that of the Ipswich skeleton—has given way. The Ipswich man has fallen headlong down the scale of time from the farthest to the nearest point of the Pleistocene period. The evidence, as it now stands, leads us to believe that between the date to which Galley Hill man has been assigned and the time which marks the final arrival of the European type, Neanderthal man was in possession of our part of the world. If modern man did make his appearance in Europe early in the Pleistocene, his stay could have been little more than temporary. Then, other evidence on which I relied to prove the permanency of the modern type—to prove how resistant it is to evolutionary change—has given way. We are so accustomed to hear Egypt spoken of as a land where men have bred true to type for 6000 years that we have come to accept the statement as an axiomatic truth. The statement is not quite true ; the type persists, but when the aggregate of its representatives is taken into account, the Egyptian type has been modified in detail. Even in Egypt evolution has not been asleep. Then I relied on the resemblance of Englishmen of the Neolithic period to Englishmen of to-day. We can still see among the men we meet survivals of Neolithic types, and if we confine our attention to stature, size, and shape of head, we shall infer that evolution has left such types untouched. It is otherwise if we enter, as I have done these ten years past, into a detailed comparison of their teeth, jaws, faces, and certain bones of their skeletons. It is then that we find that evolution is at work, and that

there are marks by which we can tell the majority of modern skulls from those of a former time.

The Rate of Evolution.—The reader may think I attach too great importance to the reputed antiquity of Galley Hill man. I do not think so, for this reason. We should like to know, not only when men of our kind came into existence, but the rate at which evolution proceeds in the shaping of man. I grew up under the belief that evolution proceeded in a leisurely manner and required long stretches of time to work out her effects—a belief I still cling to. The human brain is an organ of the utmost complexity, made up of so many parts, which require the nicest adjustment as they are elaborated; it does not seem the kind of machine that could have been produced in a hurry. All that we know relating to man's speech and accomplishments seems to indicate antiquity. Therefore the early appearance of modern man appeared to me to fit in with what we knew of the civilisation which has become part of him. The evidence, however, is going against this conception. All the early Pleistocene men, who are beyond question of that date, are more brutal, more simian, than the Galley Hill man. To turn the Rhodesian man into an Australian aborigine, an evolutionary event which may actually have happened, implies a large degree of transformation. To turn the Pleistocene Talgai lad into a modern Australian aborigine entails a marked reduction of tooth and jaw. Heidelberg man required toning down to become a representative of late Neanderthal man. Piltdown man, modern as he is in skull and brain, had a strain of the anthropoid in his teeth and jaws. We cannot run our eye over the lines on which early Pleistocene man was framed without coming to the conclusion that evolution has proceeded at a more rapid pace in the fashioning of man than some of us have hitherto thought. The only

evidence against such a conclusion is the early Pleistocene age ascribed to the remains of modern man found at Galley Hill and other sites, this evidence resting on observations made by geologists. It becomes easier to doubt this evidence than to believe that human evolution ever becomes stationary. Our doubts will be resolved definitely when we find the Pleistocene ancestor of modern man. This ancestral form has not been found as yet, and so I have left all the evidence relating to the antiquity of the modern type of European just as I set it out in 1914.

Duration of the Pleistocene.—The rate at which the human body has changed in more recent times depends on the length of time we assign to the Pleistocene period. At first sight there seems to be no means by which we can tell its duration. We proceed in national and personal affairs as if the present state of our seas, tides, and rivers was fixed and unalterable, and that our weather will continue to range within the same limits of heat and cold, drought and rain. And yet when we look closely we find sea, river, and land all changing. We have not to go back far to find the mouth of the Thames situated near the Dogger Bank in the North Sea, London high above the reach of tides, a land bridge from Dover to Calais, and a land barrier crossing the Mediterranean from Italy to Tunis. The evidence accumulates which shows there is an ever-recurring tidal movement in the earth which alters the lie of sea to land. We have not to go so far back to find England in the grip of an ice age; geologists in Europe, as in North America, are agreed that the last glacial phase ended some ten thousand years ago. There is a tide in climate which seems to accompany the tidal movements of the earth itself.

There are means by which geologists can form a conception of the earth changes wrought during the Pleistocene period, and a computation made of the time

involved. Unfortunately it has become the fashion amongst academic geologists to hold up their hands in horror when asked to compute in centuries or even millennia. One would think from this attitude that the earth only began to circulate round the sun when history began to be written. There was a time when geologists were less diffident—particularly before it became evident that man's history stretched to the beginning of the Pleistocene period. In 1900 Professor W. J. Sollas made quite a courageous and laudable attempt to fix the duration of later geological periods by noting the rate at which rivers lay down deposits now, and estimating the time needed for the accumulation of deposits of past periods. He fixed the duration of the Pleistocene period—merely to serve as a provisional estimate until a better was found—at four hundred thousand years, and of the Pliocene at five hundred thousand years.

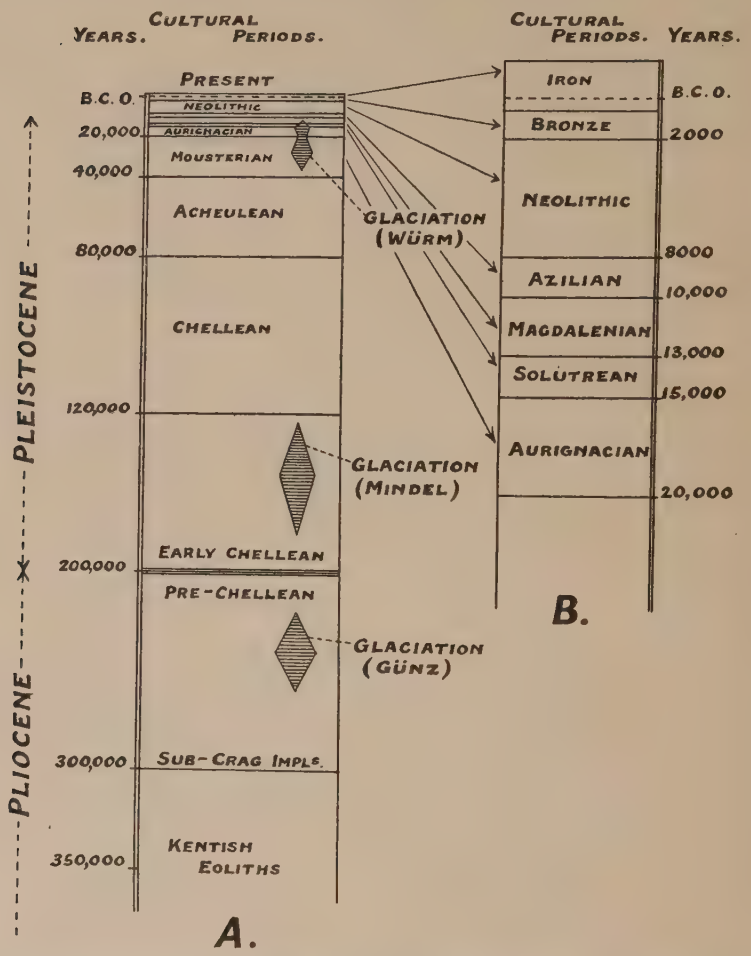
These estimates I was glad to use in my first edition; in the present one the reader will find I have reduced them by half. This reduction has been forced on me by those who are unravelling the sequence and approximate duration of the stone cultures used by man during the Pleistocene period. With our eyes turned to those ages of stone culture we get the impression that in fixing the duration of the Pleistocene at two hundred thousand years our estimate has been stretched beyond a just limit. Mr Reid Moir's more recent discoveries intensify this feeling. Not content with startling the archæological world by finding flints fashioned by human hands under the Red Crag of Suffolk—in a deposit of mid-Pliocene date—he proceeded to show that under the Cromer beds—which British geologists have hitherto regarded as marking the end of the Pliocene period—there lay buried implements of quite a high stone culture—the Chellean. If this is so, then Cromer beds are not so ancient as we supposed and

the Pleistocene period will have to undergo another reduction, becoming little more than one hundred thousand years. If only such a small sum as this is left at our disposal, then we shall have to conclude that evolutionary changes have moulded man during the Pleistocene period at a much more rapid pace than we have hitherto conceived possible. I feel, as Huxley did when Lord Kelvin reduced the time limit at the disposal of evolutionists, that there must be a mistake somewhere.

Glacial Periods.—Everyone who enters the field of prehistory must take note of glacial periods; they are geological milestones. In France, Professor Marcelin Boule finds clear evidence of only three glacial periods—one towards the close of the Pliocene; two in the Pleistocene—one near its beginning, the other near its end. Professor Marr, Professor Boswell, and many other of our leading geologists have come to the same conclusion regarding glaciation in England. There are sure signs in East Anglia of a late Pliocene glaciation—before the deposition of the Cromer beds (fig. 264). Then, after these beds were laid down, came the first and greatest of the Pleistocene ice ages, during which East Anglia was covered by its thick mantle of Chalky Boulder Clay. There was later a second Pleistocene glaciation which fell on Western Europe during the age of Mousterian culture. My difficulty has been in choosing the right names for these two Pleistocene glaciations, but I believe I am following the customary usage in England when I give the term "Mindel" to the first, "Würm" to the second, omitting the "Riss" glaciation of Germany altogether.

The Law of Uniform or Collateral Evolution.—My conception of the rapidity and manner of man's evolution has been altered in recent years by another circumstance. I have come to realise that the "law of uniform or

collateral evolution " has a wider significance than I had formerly believed. The reader will find this matter dis-



TIME CHART.—The cultural periods and their duration are those which have been adopted in this work. Three periods of glaciation are indicated. Chart B is a magnification of the upper part of the main chart, A.

cussed in my final chapter ; here I need merely say that such a law implies that species descended from a common ancestral stock may assume simultaneously characters

which the ancestral stock did not possess. To explain such an occurrence we must assume there was in the ancestral stock a latent bias or tendency to give rise to such characters, but that the tendency did not become operative until the descendants of this stock had broken up into divergent species. The matter concerns students of man's evolution in this way. We find the same structural changes taking place—apparently independently—in diverse races of mankind—changes which are not to be seen in any ancestral form. This applies to the most distinctive of all the parts of man's body—the brain. In all human forms, even the most primitive of them, we find a tendency for the brain to become large and complex. We presume that this tendency is a common inheritance in all members of the human family. The big-brained races of fossil man may not have had a big-brained common ancestor; it is enough to suppose that the ancestor had a tendency in this direction. And if this is so, we must grant that several human races may have come by large brains long after they had departed from the common ancestral stage.

Concerning Racial Migrations.—The prehistoric world is often described as if it were filled with restless hordes which wandered hither and thither, marauding and butchering. Such a picture has only a slight basis in truth. Migration, I believe, has played only the most minor part in shaping the evolution of man. What we do see is dominant types extending their lands and suppressing or extinguishing the previous occupants of these lands. This has been the case among animal species as among human races since their first appearance. Hybridisation may alter a type but it cannot give rise to novel types, such as have been produced in the course of evolution over and over again. We cannot account for the distribution of modern human racial types as seen at the dawn of

history unless we presume that they have been evolved in or near the regions of the earth which they now occupy, or did occupy, at the beginning of historical times. In seeking to explain the origin of living races the modern anthropologist is apt to suppose that the Garden of Eden is "far away" and "long ago"; not here and now. He cannot believe that he and the races which he studies are still inside the walls of an evolutionary garden—one which extends from pole to pole. Yet this is the belief which a close study of human races in past and present times compels the earnest student to adopt. The more densely populated parts of the world are also the centres of most rapid evolution. We have to presume, until we can prove to the contrary, that each racial type has been evolved in that part of the world where now we find it, and we have to apply this rule not only to living races but to extinct and fossil races of mankind.

The Piltdown Controversy.—When writing the first edition of this book, the dispute concerning the status of Piltdown man—to be strictly accurate one should rather speak of Piltdown woman, but the male sex has always been chosen as a racial representative—was still unsettled. I had good reason for thinking that the model in which Sir A. Smith Woodward had portrayed the features of this very ancient Englishwoman was a misrepresentation, so in my first edition I set out her structural peculiarities at great length, believing that those who were learned in the language of the skull would see the reasonableness of my contentions. It had become evident by then that the long-past history of man had to be written from an expert study of craniological hieroglyphs. I knew I should tax the patience of ordinary readers by thrusting before them matter which was intended chiefly for the eye of experts. I had intended to discard these technical chapters in the present edition, but seeing how little some

of my professional brethren have fathomed the art of setting cranial fragments together I have thought it wiser to leave them untouched. Nay, I fear I have become a greater sinner than ever, for I have given a whole technical chapter to the facial skeleton of Rhodesian man alone.

The system pursued in this book, wherein the reader is taken on a series of tours to prehistoric sites, has certain inherent advantages and also certain disadvantages. In a more systematic treatise one can take up subject after subject, examine each, and give a final verdict. But when we proceed to examine evidence by making a series of visits, we have to discuss matters as opportunities occur, and hence the reader will find that the discussion of some subjects occurs sporadically in several chapters. To amend this defect the index has been made full and explicit.

As in my first edition, so in this, I owe much to many professional colleagues—more than I can name here. Especially am I indebted to Mr Hastings Gilford of Reading, to Dr Rushton Parker, to Mr Morley Roberts, and to Mr Meredith Sanderson for pointing out to me verbal and other errors in the text of my first edition. The liberality extended to me by the President and Council of the Royal College of Surgeons of England I gladly acknowledge here. The Museum of the College has provided me, as it does all students of the human body, with unrivalled advantages. Nor must I forget to mention the help which I have received from Mr William Finerty and Mr E. Smith in the preparation of diagrams to illustrate my text.

ARTHUR KEITH.

Royal College of Surgeons
of England, *Jan.* 1925.

PREFACE TO FIRST EDITION

FULLY fifty years ago—in 1863, to be quite exact—Sir Charles Lyell told the story of the antiquity of man from a geologist's point of view. His book [1] became a classic ; the geologist came to be regarded as the official historian of ancient man. The modern successors of Sir Charles Lyell have maintained the position he established for them. In the books of Sir William Boyd Dawkins,[2] of Professor W. J. Sollas,[3] of Dr G. Frederick Wright,[4] and of Professor James Geikie,[5] the world of our remote ancestors is made to live again. The antiquity of man, from a geologist's point of view, has thus been placed clearly and fully before the English reading public. In 1865, Lord Avebury—Sir John Lubbock he was then—approached the problem of man's antiquity from another point of view. He was primarily interested in the culture, the industry, the civilisation of ancient man ; the geological details of the prehistoric landscape took a secondary place in his pictures of prehistoric times.[6] He sought to follow the human army to its beginning in the remote past by tracing the possessions it had discarded while on the march. Lord Avebury wrote the story of the antiquity of man from the archæologist's point of view.

[1] *The Geological Evidences of the Antiquity of Man.* London, 1863 (1st edition).

[2] *Cave Hunting*, 1874. *Early Man in Britain*, 1880.

[3] *Ancient Hunters*, 1911.

[4] *The Origin and Antiquity of Man*, 1913.

[5] *The Antiquity of Man in Europe*, 1914.

[6] *Prehistoric Times*, Williams & Norgate, 7th edition, 1913.

The problem of man's antiquity may be approached from another point of view—that of the human anatomist. The anatomist gives ancient man the centre of the stage ; he depends on the geologist and archæologist to provide him with the scenery and stage accessories. It is from the anatomist's point of view that the problem of man's antiquity is dealt with in this book. This method of approach has its difficulties. The anatomist has to trace man into the past by means of fossil skulls, teeth, and limb bones—intelligible documents to him, but complex and repulsive hieroglyphs in the eyes of most people. The publishers have assisted the author to surmount the more technical difficulties by allowing a very liberal use of explanatory diagrams, which make the arguments used in the text more intelligible to the general reader. In many respects this book is supplementary to Lord Avebury's classical work—*Prehistoric Times.*

The main reason for the appearance of this work at the present time is that the " mystery " of man's antiquity is now culminating in a critical phase—presenting situations which may be described as of almost absorbing interest. Indeed the manner in which the story of man's antiquity is now developing recalls the point reached by Dickens in his last and unfinished novel—*The Mystery of Edwin Drood.* Many learned men have sifted the evidence and tried to solve the problem of Drood's fate—some solving it in this way and some in that. At the present time, geologists, archæologists, and anatomists are sifting the evidence relating to the combined problem of how and when mankind came into existence. On the evidence at present available, the author is convinced that the true solution cannot differ materially from the one presented in a diagrammatic form in the frontispiece of this book. The author's solution is only one of many ; time will show which is right.

The mystery of Edwin Drood we can never solve; only the novelist knew what fate had in store, and he carried the secret to his grave. The mystery of man's antiquity stands in a different position. Every year brings new evidence to light—places facts at our disposal which take us a step nearer to a true solution. In recent years discoveries of fossil man have crowded in upon us, yielding such an abundance of new evidence that we have had to reconsider and recast our estimates of the antiquity of man. No discovery of recent date has had such a wide-reaching effect as that made by Mr Charles Dawson at Piltdown, Sussex. Hence the reader will find that a very considerable part of this book is devoted to the significance of that specimen of humanity which Sir A. Smith Woodward named *Eoanthropus dawsoni*.

In accumulating the material and facts on which this book is based the author has become deeply indebted to many men. The help of some he has acknowledged in the text, but there are many whose names do not appear there. The omission does not mean that he is not grateful to them for their help. He must, however, acknowledge here the assistance he has received from time to time from the officers of the British Museum, from Mr J. Reid Moir, Mr A. S. Kennard, Mr W. H. Cook, the Rev. Edwin H. Mullins, and Mr Courtney Lyne. For assistance in preparing illustrations for this work he is indebted to his friend, Dr Stanley Beale, and particularly to Mr William Finerty.

ARTHUR KEITH.

July 1914.

ADDITIONAL NOTE TO PREFACE OF FIRST EDITION

A YEAR has passed since the proofs of this book were corrected and its preface written. The events of the year have revolutionised the outlook of all of us; we have burst suddenly into a critical phase in the evolutionary progress of mankind; we have had to lay aside the problems of our distant past and concentrate our thoughts and energies on the immediate present. Liège and Namur, which figure in this book as the sites of peaceful antiquarian discovery, have become the scenes of bloody war. And yet, amidst all the distractions of the present time, the author hopes there may be some who will wish to survey the issues of the present fateful period from the distant standpoint of a student of man's early evolution. It is in such a hope that this book is now put forth.

A. K.

July 1915.

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THE ANTIQUITY OF MAN

CHAPTER I

A NEOLITHIC COMMUNITY OF KENT

The road from London to Maidstone, once it has made a steep descent from the North Downs, winds through a district abounding in traces of long-past generations of Kentish men. The traveller along this road, with his face turned eastwards, be he ever so interested in the study of ancient man, cannot fail to note the picturesqueness of the Kentish weald. From time to time he passes villages which have preserved, in spite of a whirling stream of motor traffic, much of an old-world atmosphere. Ever on the left hand, a few miles distant from the road, the traveller sees across the hedges and orchards the steep flank of the North Downs, which trend eastwards to end in the white cliffs of Dover. Here and there he may trace the Pilgrims' Way as it winds along the foot of the steep grey face of the Downs, the mediæval path to the shrine at Canterbury. The great stone monument at Coldrum, which is to give us our first glimpse into man's past, could be reached by following the grass-grown pilgrims' path; but then if that route were taken we should miss the picturesque village of Ightham and the home of the late Mr Benjamin Harrison,[1] who made

[1] Mr Harrison died at his humble home in Ightham, 30th September 1921, in his eighty-fourth year. He earned a scanty livelihood as the village grocer, his last years being made easier by the grant of a small pension from the Civil Service List. In his youth he sought to do for Kent what Boucher de Perthes had done for the valley of the Somme, and in his search for Palæolithic implements in valley gravels was soon successful. As early as 1864 he had noted the kind of chipped flints, afterwards known

this part of Kent a Mecca for all students of early man. We are in the centre of some of Mr Harrison's most important discoveries. On the plateau of the North Downs, stretching northward from the steep slope which now faces us until it sinks into the valley of the Thames, Mr Harrison gathered those rudely worked flints—eoliths—the earliest form of tool ascribed to man. Close by Ightham, hid in a wood, are the Oldbury rock-shelters where Mr Harrison found over three hundred flints worked in exactly the same fashion as those chipped by the cave men in the south of France when the rigorous climate of the Ice age was giving place to our more genial times. On the plateau a few miles away lie the oldest and rudest of human tools—for I am assuming that the reader admits the humanity of Mr Harrison's eoliths, while here, amongst the earth that has gathered at the foot of the projecting rock, almost burying it, are the stone implements—palæoliths—which mark the last phase of the Palæolithic period.

We are not concerned at this point with the immeasurable stretch of time that lies between the earliest of the eoliths and the latest of the palæoliths ; in following man into the past we are to start from that period or age of culture which succeeded the Palæolithic—the Neolithic. All over this district, on the ploughed fields and in the woods, the keen and delicately worked flints which are characteristic of the Neolithic stage of man's history can be picked up. How long the Neolithic period lasted in England we cannot yet say with any degree of certainty, but we are all agreed that it came to an end about 2000 B.C., when bronze became known to the men of Western Europe. We have only to visit Rose Wood, within a short distance of Mr Harrison's home in Ightham, to see that the passage from the Palæolithic to the Neolithic period was marked by a much greater change than a mere alteration in the manner in which flint implements were fashioned. In Rose Wood is

as "eoliths," in the plateau gravels of Kent. He drew the attention of Sir Joseph Prestwich to them in 1888.

the evidence that men were no longer vagabonds and wanderers, but had settled down in communities. Hid in the undergrowth of this coppice [1] is a series of circular depressions, some forty in number, marking the sites of the pit-dwellings of a Neolithic village.[2] These ancient dwellings were explored over fifty years ago by the Kent Archæological Society. They were found to be circular "basin-like pits, 5 to 10 feet deep and 15 feet in diameter." Round the pits were found fragments of rude pottery and numerous flint flakes and implements. Near by is Oldbury camp—also the work of the Neolithic period.

As we turn our backs on the pit-dwellings and Oldbury camp to gain the main road and again face eastwards, it is possible that the significance of what we have just seen may escape us. So far as we know at present, the men of the more ancient or Palæolithic period had no conception of house-building or of settled communities, of defence works or of pottery. These were, with perhaps the exception of the last, discoveries of the Neolithic period. Further, it is manifest that settled communities are only possible when the land is tilled and cattle are domesticated. Agriculture was the slow and laborious invention of the Neolithic age. It does not cut the Neolithic age any shorter if we suppose—as we must suppose—that agriculture was not evolved in Western Europe. In a distant part of the world, as we shall see presently, man did slowly and laboriously discover the art of bringing plant and beast into his service. The essential feature of man's Neolithic life was not that he fashioned stone implements in a certain manner, but that he tilled the soil and lived in settled communities.

Ightham, where we left the main road, is thirty miles from London; six miles farther along the road lies the village of West Malling (fig. 1). To this village Mr F. J.

[1] For an account of the antiquities of the Ightham district, see *Ightham—the History of a Kentish Village*, by F. J. Bennett, F.G.S., 1907.

[2] For pit-dwellings in Kent, see Geo. Clinch, *Journ. Anthrop. Instit.*, 1899, ser. 2, vol. ii. p. 124.

Bennett had retired, after a long and active career in the service of the Geological Survey under the British Government, to spend his leisure hours in busily interpreting the traces of ancient man in the county of Kent. The Coldrum Megalithic monument, to which we are now making our way, was the particular object of his attention in the year 1910. It is true that the late Mr A. L. Lewis [1] had recognised the importance of the monument in 1877, and published an accurate plan of the arrangement of the stones; but it was left for Mr Bennett to reveal its

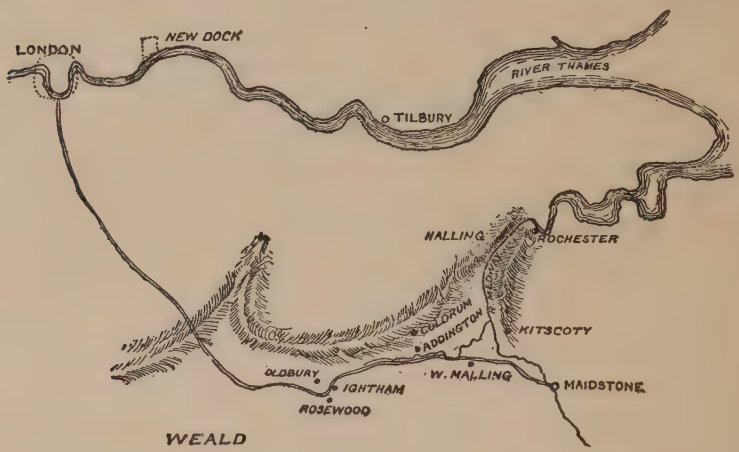

FIG. 1.—A map of the part of Kent in which Coldrum is situated.

secrets and the light it could throw on the Neolithic inhabitants of Kent.[2] To reach Coldrum we follow a farm track which opens from the main road before the village of West Malling is reached. Before us, to the north, and some three miles distant, is the grey, dry pasture-land that clothes the sharp face of the North Downs. Sweep away the snug farms which lie sheltered in the weald below the Downs and on the uplands of the plateau above them, replace the hedged fields with little

[1] See *Journ. Anthrop. Instit.*, Nov. 1877.

[2] Research on this monument is being continued by Mr E. W. Filkins. This and other Megalithic monuments of Kent are being studied by Mr J. H. Evans of Rochester and Mr W. H. Cook of Snodland (1924).

terraced cultivated plots, and we have before us exactly the country that Neolithic man inhabited four or five thousand years ago. On our right, as we proceed northwards, we see the same valley of the Medway opening out before us as it did before him, except that the smoke which sweeps towards us from the cement works of the gorge, by which the Medway makes its way northwards through the Downs to reach the Thames, was unknown

FIG. 2.—Megalithic monument at Coldrum viewed from the east (Dr Stanley Beale).

in his time. When we reach the monument, a little distance short of the Downs, we see that it is not as Neolithic man left it. Time and circumstance have defaced it. We pass the farm and reach the raised corner of a field on which the monument stands. Half a mile farther to the north is the Pilgrims' Way along the foot of the steep escarpment. We climb the slope that takes us to the main or central chamber situated on the eastern side of the monument (fig. 2).

The great stone which closed the eastern end has

fallen forwards and exposed the interior of the chamber, or as we may now name it—for the nature of such chambers is well known—the tomb. It is a commodious chamber,[1] 12 feet 3 inches in length, east to west, and 5 feet 8 inches in width, from north to south. When Mr Lewis first saw the central chamber, a great vertical slab divided it into an eastern and western half, each being sufficiently long to provide a wide bed for a six-foot man. The flat massive stone which forms the southern wall of the chamber shows that the Neolithic men of Kent were engineers of no mean ability. It stands 7 feet 3 inches high, is 11 feet 3 inches long, and 1 foot 9 inches thick—thus weighing many tons. That mass the men who lived in pit-dwellings transported and set up on this elevated spot. Three other vertical stones make up the northern and western walls. No covering or roofing stone is now present; the chamber lies open to the sky. On the opposite or eastern side of the Medway valley, another Megalithic monument—Kits Coty House—retains the great roofing stone (fig 11).

The central chamber is only part of the Coldrum monument; as Mr Filkins' plan shows, an irregular series of blocks surrounds the central chamber, enclosing a space, now overgrown with weeds and bushes, about 50 feet square. The monument was evidently set within and formed part of the eastern side of this square. In its original state the central chamber was probably roofed, the encircling stones formed the retaining wall of a great mound which covered the tomb, the entrance being from the eastern side (fig. 9). Whatever its exact original form may have been, this at least is certain: the minds of those ancient inhabitants of Kent must have been deeply moved by a faith in things unseen and firmly convinced of a human existence untrammelled by the flesh.

On 16th April 1910, Mr Bennett visited the central chamber. In the Megalithic monument at Addington, about a mile due south of Coldrum, he had picked up

[1] For a detailed description, see Mr Bennett's paper, *Journ. Roy. Anthrop. Instit.*, 1913, vol. xliii. p. 76.

Neolithic flakes ; he was now searching for similar traces of Neolithic man at Coldrum. " No sooner," he writes,[1] " had I put my fork in near the west wall than I at once turned up, and under only a few inches of chalky soil, some human bones. This find I kept to myself, and determined to do no more without someone present to

FIG. 3.—Surface-plan of the Coldrum monument, from a survey made by Mr E. W. Filkins.

keep and record further finds in an area apparently so full of human remains." With the consent of the Lord of the Manor, the Hon. R. P. Nevill, and with the assistance of Mr E. W. Filkins, Mr Bennett made a systematic examination of the central chamber, digging deeply into its floor. Besides human bones, only a few fragments of a rude pottery and a flint saw were found. Not a

[1] *Journ. Roy. Anthrop. Instit.*, 1913, vol. xliii. p. 81.

trace of any object belonging to a culture later than that of the Neolithic age came to light.

There is not any doubt in my mind that the bones thus discovered by Mr Bennett were those of the people primarily interred in this Megalithic tomb. Once chalk has permeated the porous texture of bones, preservation is secured. The Coldrum bones ring like porcelain when struck; the tongue adheres to the freshly fractured surface, showing that the bones no longer contain animal matter. In this manner we came by the material which provides us, for the first time, with the means of forming a true picture of what the Neolithic people of Kent must have looked like in the flesh—the people whose beliefs were centred round the Megalithic monuments. I do not propose to weary the reader with the details of my examination of the bones; they are already on record;[1] all I propose here is to give in outline the mental picture which my investigation led me to form of the people.

When I had arranged all the fragments, I found that at least twenty-two individuals were represented; they were of all ages, from newly born children to old men and women. Unfortunately the skulls, which give us the surest evidence of the racial nature of a past people, were few and fragmentary. There were only five, out of a group of nine, complete enough for our present purpose. But a certain feature of these skulls throws a curious sidelight on the nature of the monument. In a great number of them there were present peculiarities in their formation which could only be accounted for by supposing that the people buried in the tomb were of one family or of nearly related families. Three of the nine skulls had anomalous bones set within the joinings or sutures of the vault (see fig. 4); some of the others showed irregularities in the manner in which the sutures between the skull bones became closed.

They were people of short stature; from the length of the thigh bones the stature of the men was estimated to have been about 5 feet 4½ inches (1·648 m.), and

[1] *Journ. Roy. Anthrop. Instit.*, 1913, vol. xliii. p. 80.

that of the women about 5 feet 1 inch (1·550 m.). They were thus 2 or 3 inches below our modern British average. In size of brain they were apparently not below our standard. Indeed, the three male skulls had a capacity of 1600 cubic centimetres—an amount considerably above the mean for modern men—1480 c.c.; the two female skulls had a capacity of 1450 c.c., which is also above the modern mean for women—1300 c.c. No importance can be attached to figures founded on a group of five skulls; in every race, ancient and modern, the brain is found to vary widely as regards size. Such observations as those just cited simply show us that Neolithic man, as regards brain size, had at least reached our modern standard.

It is also quite apparent that the Neolithic men in this part of England did not depart very widely from their modern successors as regards form of face and head. How near those Coldrum skulls come to modern specimens will be seen from fig. 4. I have taken one of the Coldrum specimens and set it, as seen in true profile, within a standard frame which bounds the chief limits of a modern Englishman's skull of mean size. The dimensions actually used are founded on the measurements made by Dr Macdonell [1] on a large number of plague-pit skulls (seventeenth century) exhumed in the East End of London some years ago. Dr Macdonell determined the mean length of the male skulls to be 189·1 mm.; I have made the length of the standard frame in round numbers, 190 mm.—just under 7½ inches. The width he found to be 140·7 mm.; again I have taken round numbers and made it 140 mm. The width is approximately 74 per cent. of the length. Any race of men in which the width of the head measures 75 per cent. of the length, or less, we count long-headed or dolichocephalic; if the width is 80 per cent. or more of the length, then the race falls into the short-headed or brachycephalic group; the races falling above 75 per cent., and under 80 per cent., form an intermediate or mesocephalic group. Amongst

[1] *Biometrika*, 1904, vol. iii. p. 191.

individuals of even the purest races a wide degree of variation in head width is found; we determine the place of the race by striking the mean of a series of measurements on many individuals.

The height of the vault above the ear-holes is also important. In the Whitechapel skulls—those regarded as males—the vault rises to 114 mm. above the ear-holes; the vaults of the English skull are low pitched. In the standard frame I have pitched the vault level at 115 mm. Now, when one of the Coldrum skulls is placed

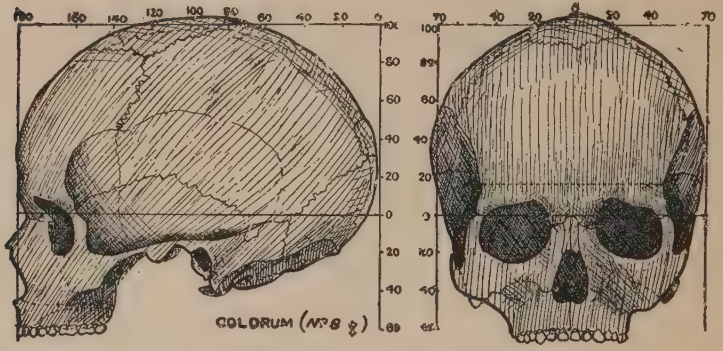

FIG. 4.—One of the Coldrum skulls set within a framework of lines which bound the chief diameters of a modern skull of mean size. The skull is represented in two aspects—profile and full-face. On the vault, the anomalous bone mentioned in the text is represented.

within the standard frame (fig. 4) it is seen to fit fairly well. If a composite outline were made from the three male skulls, the length of the composite skull would be 190·5 mm., its width 140 mm., the height of the vault 118 mm. The width is 73·3 per cent. of the length. The two skulls regarded as females are relatively wider, the width index (cephalic index) being 77·9. Clearly in form of skull the race with which we have to deal lies towards the upper limits of the long-headed range. In actual dimensions of the head and in the proportion of width to length, this small sample of Neolithic people is not materially different from a modern group of English people of the industrial class; but they do differ from

a sample of the Kentish people who lived at Hythe, on the southern coast of Kent, in mediæval times. During the last few years my friend, Professor F. G. Parsons,[1] has done much to unravel the evolution of the modern Englishman. In the crypt of the church at Hythe, he examined nearly five hundred skulls of people who lived in mediæval times. The heads of those Hythe people were differently shaped from the Neolithic people of Coldrum. They were shorter and broader and higher; the maximum length of the males was only 179 mm., the width 142 mm., the height 120 mm., the cephalic index 79·9 per cent. The mediæval people of Hythe were on the border-line of the short-headed class. In accounting for the difference in head form between Neolithic and mediæval people, one has to remember that in the Bronze age typical round-headed people invaded Kent, and at later dates, both before and during the Roman occupation, and also during the Anglo-Saxon invasion, many fresh racial elements were imported into the population of this county.

I am lingering round this small group of Coldrum people because they have to serve as a standard for our subsequent inquiries regarding the bodily features of ancient races of men. When a skull is viewed in full face (fig. 4) we have an opportunity of standardising another series of dimensions. Indeed when we have to distinguish one race of mankind from another we obtain more assistance from the facial than from the cranial parts of the skull. The greatest width of the face is measured between the bony arches (zygomatic) which can be felt on each side of the head passing from the ear to the eye-socket. The width of the face of the male Whitechapel skulls is 130 mm.; that we shall use as a standard width. The width of the forehead is also important. The lower width is taken between the outer ends of the ridge which crosses the forehead above the orbits—from the outer end of one external angular

[1] See *Journ. Roy. Anthrop. Instit.*, 1908, vol. xxxviii. p. 419; also 1910, vol. lx. p. 483.

process to the outer end of the opposite process. The upper width (indicated by a stippled line in fig. 4) is taken between the temporal lines which bound the areas on the sides of the skull (see fig. 4) occupied by the temporal muscles—muscles of mastication. The difference between these two frontal measurements is of some value. In skulls of a primitive race the lower or supra-orbital width is much greater than the upper or true frontal width. As regards the frontal widths, the Coldrum individuals show the same relative proportions as modern English people. In measuring the length of the face the forehead is not included. The forehead is really the anterior wall of the brain case; it is not, in an anatomical sense, part of the face. The length one desires to measure is from the *nasion*—the point where the bridge of the nose abuts on the forehead—to the lower margin of the chin. The lower jaw is so often missing in ancient skulls that it is usually impossible to obtain the "total" face length; hence we have to rest content with what is known as the "upper" face length—the distance as measured by calipers between the nasion and the point between the roots of the two central upper incisor teeth, the *gnathion*. Even as regards this measurement there is only one Coldrum skull available. All we can say, taking certain fragmentary parts into account, is that the face of this group of Neolithic people was rather shorter than in modern people and of about the same width.

When we come to analyse the characters which distinguish the people of the Neolithic period from the present population of Britain, we see that the changes affect, in the first place, the teeth, jaws, and face. Amongst modern Kentish folk, as is the case all over modern Britain, there is a tendency to crowding and irregularities of the teeth; the palate and jaws do not grow and expand sufficiently in youth to give room for a symmetrical eruption of the teeth. There is a decided tendency to a narrowing and elongation of the face—a tendency to produce a face of a hatchet-shaped pattern.

The nose is narrow and the palate contracted, and its vault is high. The teeth are not worn down as in Neolithic men; they are very liable to be attacked by caries. The front teeth, when the jaws are closed, do not meet edge to edge as in primitive races; like the blades of scissors, they overlap, the lower passing behind the upper. In the Neolithic people all these modern characters are absent. Abscesses or gumboils at the roots of the deeply ground teeth, however, were common; but there is not a single carious tooth to be seen in the Coldrum collection. The teeth are regular in their arrangement, the palates well formed, but in actual size the teeth possess the same dimensions as those of modern English people. All these changes, which are appearing in the teeth and jaws of modern British people, arise, we suppose, from the soft nature of our modern diet. We believe that were modern men to resume a Neolithic diet their teeth and palates would again be moulded in the ancient manner.

It is not only in face and mouth that well-marked changes can be recognised. The bones of the lower extremities of Neolithic people were shaped in a different mould. The upper parts of the shafts of the Coldrum thigh bones are flattened in their upper parts, as if they had been compressed from front to back; the bones of the leg or shin are much more flattened from side to side, and the bones which form the ankle and foot are shorter, stouter, and show more extensive joint surfaces—evidence of freer movement. We cannot explain the disappearance of these characters. Perhaps the modern conditions under which we live—our clothing, our boots, our roads and streets—have brought about a remoulding of the lower limbs. The solution of those problems awaits further investigation. In the meantime we merely note the fact that the men of Kent do differ in certain bodily features from their predecessors of four thousand years ago. Time and environment appear to have worked certain changes in the structure of the human body.

The Neolithic men of Kent were thus of short stature,[1] with rather large heads in which the width was about 75 per cent. of the length. What were people in other parts of England like at this period—the later part of the Neolithic age? So far as we know they were all long-headed, not very different in size and form from those found at Coldrum. The people found in the long barrows of the Neolithic period appear to belong to the same race as the Coldrum individuals. The skull I wish to cite as typical of the Englishman of the Neolithic period is that known as the Trent or Muskham skull.

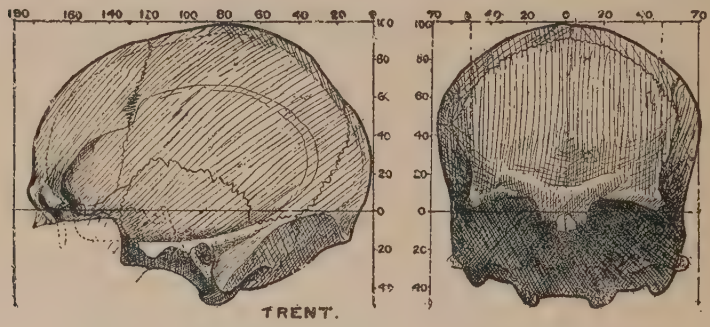

Fig. 5.—Side and front views of the Trent cranium.

It was found in an ancient bed of the Trent, at Muskham, near Newark, Nottingham, buried naturally in deposits laid down by the river. The objects found with it show that it is of Neolithic age. Huxley [2] described it in 1862, and made it the representative of what he named the "river-bed type" (fig. 5). The earliest Neolithic skulls we know of in England are of this type; the Coldrum and long-barrow skulls are merely variants

[1] The standard article on the stature of prehistoric man is that by Professor Karl Pearson in the *Philosophical Transactions*, 1898, vol. cxcii. p. 169. The stature of the modern Englishman he estimates at 1700 mm. The mean of the three Coldrum men I have calculated to have been 1648 mm.—2 inches less.

[2] *Prehistoric Remains of Caithness*, by Samuel Laing. Williams & Norgate, 1866. The Muskham or Trent skull is in the museum of the Royal College of Surgeons, England.

of the type. The "river-bed" form of head is not confined to Neolithic England. In an adjoining figure I have placed corresponding drawings of a skull from Malta—from that subterranean sepulchre of the Neolithic age, the Hypogeum at Hal-Saflieni—which Dr Zammit,[1] the curator of the museum at Valetta, has given me an opportunity of investigating, as well as several other Maltese specimens of the Neolithic period. When we compare the Neolithic skulls from Coldrum and from Malta we see so many points of resemblance that we must regard them, not perhaps as of the same

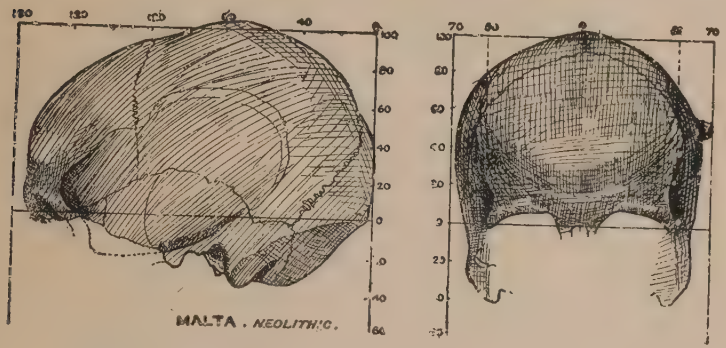

FIG. 6.—Side and front views of a skull from a Neolithic burial-place in Malta.

race, but as belonging to members of a closely related group of races. The name which must be given to this group of Neolithic races—the races characterised by a "river-bed" type of skull—there also can be no doubt about. The veteran Italian anthropologist, Professor Sergi,[2] has clearly proved that the type of skull represented by the Maltese specimen (fig. 6) is characteristic of the people who lived in the lands which bound the Mediterranean—from the Levant to the Straits of Gibraltar—during the Neolithic period. Sergi's Mediterranean race had heads which in size and form were of the

[1] See Reports of Explorations of Hal-Saflieni Prehistoric Hypogeum. Malta, 1911, 1912.

[2] *The Mediterranean Race*, London, 1901.

"river-bed" type. The back of the head, in place of being flattened, projected backwards as a boss or cap—the occipital boss seen in the Coldrum skulls. The ancient Egyptians were also members of the Mediterranean group—perhaps rather aberrant members. In fig. 7 I reproduce a composite diagram, made from the measurements of five specimens, representing the skull-form of male Egyptians of the Sixth Dynasty—of men who were living in Egypt between four thousand and five thousand years ago. When the Egyptian, Maltese, and Kentish

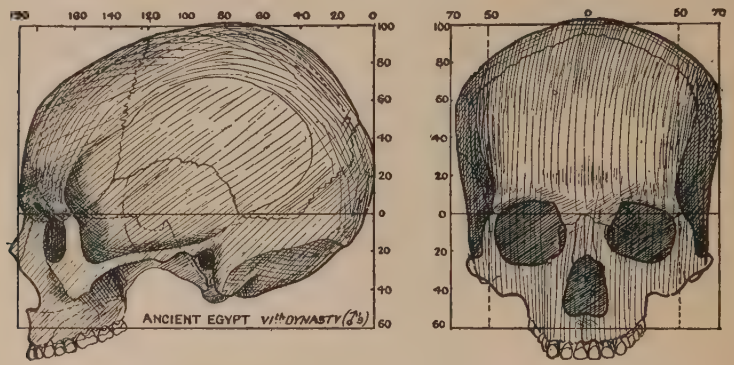

FIG. 7.—Form of skull of ancient Egyptians of the Sixth Dynasty, from the side and from the front.

skulls of the Neolithic period—at least Neolithic as far as England is concerned, for in Egypt and along the shores of the Mediterranean the use of copper and bronze was already known—are compared, it will be seen that they differ in detail, but in general form are of the "river-bed" type. We find the same type in the Neolithic people of Spain, France, Switzerland, North Germany, and Scandinavia.

We see, then, that the little group of folk whose remains were buried in the central chamber at Coldrum was not an isolated patch of people; they were a sample of the kind of men who lived in Western Europe in the Neolithic period. The same, or a closely allied race, was spread eastwards along the shores of the Mediterranean,

both on the European and on the African side. Already in the Neolithic period the Mediterranean type of man, with a well-defined form of head or skull, was differentiated into local groups or varieties. It must not be thought that the people who built the Coldrum monument are counterparts of the people who built the pyramids. They were men of the same type, and we must suppose, in order to account for their resemblances, that they arose, at some remote period, from a common race or stock. We can detect, however, in the ancient Maltese and in the ancient Egyptian skulls certain negroid features—features which are absent in the skulls of the Neolithic people of Western Europe. Further, we know that at the very dawn of the Neolithic period a great wedge of round-headed humanity had been thrust into central Europe—with its base in the East and its advancing Western edge almost on the shores of the North Sea. If one of these ancient men of Coldrum had applied himself to the study of anthropology and sought to account for the origin and distribution of the races of Europe, he would have had to face just the same complicated problems as we have to grapple with now. Mankind was then already old; the human web already universal.

The Coldrum people not only shared their physical characters with the people of Western Europe, but they also participated in the mental life of their time. The monument itself is proof of this. We must infer that the people who set up such monuments along the shores of the Mediterranean and in Western Europe during Neolithic times must have been stirred by a common code of beliefs concerning life and death. In seeking for an explanation of the Coldrum monument, I follow the lead of Professor Elliot Smith.[1] In his opinion, the birthplace of such monuments is ancient Egypt; the time of their evolution there—the five or six centuries which

[1] See *Ancient Egyptians*, Harper Brothers, 1911; 2nd edition, 1923. *Essays and Studies presented to William Ridgeway on his Sixtieth Birthday*, Cambridge, 1923. *Man*, 1913, vol. xiii. p. 193.

mark the establishment of the early dynasties—from 3300 B.C. onwards. During this period, the original simple Egyptian grave became an elaborate home for the dead—such as is shown in the accompanying diagram (fig. 8). Such a grave consisted of a mound or tumulus bounded by four retaining stone walls. The approach to the tomb was usually placed facing the Nile, on the eastern side, where the retaining walls were extended to

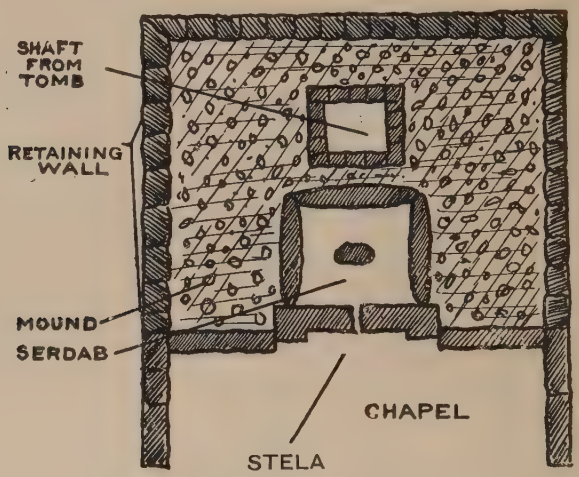

FIG. 8.—Ground-plan of an ancient Egyptian mastaba and tomb (Elliot Smith).

form a vestibule or chapel, in which offerings were made to the dead. Within the mound or tumulus was a small chamber—the serdab—" the home of the dead man or of his disembodied spirit," an opening in the stela allowing the spirit access to the offerings in the chapel. Under the tumulus lay the burial chamber, connected with the mound or tumulus by a vertical shaft. Such is the type of structure which had been elaborated in the course of centuries by a highly organised and ancient Egyptian community. In the Neolithic tombs of Sardinia—the giants' tombs [1]—the structure is somewhat simpler (fig. 9).

[1] See Dr Duncan Mackenzie's article in *Memnon*, 1909, vol. ii.

The spirit chamber or serdab and the burial chamber are not separated; the common central chamber of the tumulus or mound now represents, in the opinion of Professor Elliot Smith, the united serdab and burial chamber. The supporting walls of the mastaba are prolonged on one side to form an approaching chamber or chapel. The plan of the Sardinian tomb proves of assistance when we come to interpret the various parts of the Coldrum monument. It possesses the great central chamber, originally approached by the declivity on the

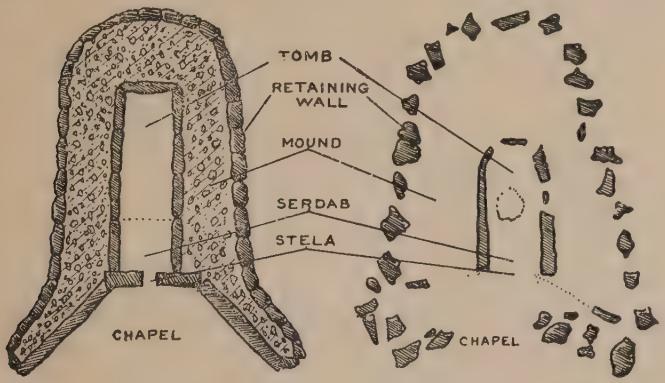

FIG. 9.—On the left, a ground-plan of a "giant's tomb," Sardinia. On the right, a sketch-plan of the Coldrum monument altered to show points of resemblance to the "giant's tomb."

eastern side (fig. 9). The stones, now disposed irregularly round the central chamber, evidently formed a supporting wall for the mastaba or mound—long since removed. At the eastern end, it is evident from the disposition of the outlying stones (fig. 9) that the retaining wall on each side of the approach or entrance was carried forwards to enclose a chamber—similar to the chapel of the Egyptian tombs. In the monument, then, we have evidence that the Coldrum people participated in the beliefs which swayed the people of Western and Southern Europe in the Neolithic period. The Megalithic monuments represent the mosques, the churches, and chapels of the Neolithic age—concrete expressions of inward beliefs.

I have selected Coldrum as a starting-point for a survey of ancient man because it provides us with a series of facts which show that in the essentials of life and of bodily form the Englishman of the Neolithic period—of four thousand years ago—was not materially different from his modern successors. We have changed the form of our beliefs, we have transformed our clothes and our homes and revolutionised our means of livelihood, but in brain and body we have changed only in minor details. We may presume that evolution works slowly so far as the human body is concerned.

One other point may serve to show that the status of Neolithic man was higher than is usually supposed. In various parts of France the people of this period buried their dead in caves or large artificially prepared subterranean chambers. None of these Neolithic sepulchral chambers has been more systematically and scientifically investigated than the one accidentally discovered in 1908 on the side of a hill, at Vendrest, some sixty miles to the east of Paris.[1] Remains of over a hundred and twenty individuals, representing both sexes and all ages, were found within this ancient tomb. A fall of earth and rocks had buried the doorway of the sepulchre about the close of the Neolithic period, for all the worked flints and ornaments found within the sepulchre were of that age of culture; no traces of the Bronze or Iron periods were found. No less than eight of the skulls had been opened during life by the operation known as trepanning or trephining. It is clear, too, that in the majority of cases those Neolithic men undertook and successfully carried out operations which even modern surgeons hesitate to perform (fig. 10).

When we try to fathom the reasons which led men so long ago to practise these daring surgical procedures, we have to study the art of surgery as practised amongst modern primitive races. Lately, Dr W. E. Redman presented to the museum of the Royal College of

[1] *La sépulchre néolithique de Belleville à Vendrest:* Rapport général par Dr Marcel Badouin. Société Préhistorique Française, 1911.

Surgeons, England, five skulls showing how the operation of trepanning is carried out by the natives of New Ireland, one of the islands in the Bismarck Archipelago, to the east of New Guinea. Accompanying the skulls are the sharp obsidian flakes with which the operation was performed and the vegetable bandage which was applied to secure the dressings over the wound. Recent discoveries have explained why an opening in the skull may relieve certain forms of headache, and it is probable that the operation is sometimes performed amongst primitive people for such a condition. At other times, perhaps, trepanning is performed to allow the demon of insanity, or of epilepsy, to escape. Trepanning was frequently performed by the ancient Peruvians. During the Neolithic period this operation was apparently unusual in England, for recorded examples are very few.[1]

FIG. 10.—Skull from a Neolithic sepulchre in France, which had been trepanned in three places. The patient had recovered, for the margins of the openings are healed over.

The reader may draw the conclusion that an operation performed by the natives of New Ireland cannot be regarded as a mark of a high state of mental evolution. Such an inference is scarcely just: a people who practise the operation of trepanning must entertain certain beliefs concerning the constitution of the human body—beliefs which provide them with the principles on which their actions are based.

The instances I have just cited have other bearings on the problem of man's antiquity. How does it come

[1] See article by Dr Wilson Parry, *Lancet*, 1914, i. p. 1699. *Proc. Roy. Soc. Med.*, 1921, vol. xiv. p. 1 (History of Med. Sect.).

about that in ancient Peru, in Neolithic France, in the New Ireland of to-day, we find the same daring and difficult operation carried out? Has each people discovered the practice for itself, or—as seems to me more probable—was it not evolved so long ago that it has permeated the whole stock of modern man? Further, the operation of trepanning shows us that a civilisation which prevailed four thousand years ago in one part of the world is to this day represented in the modern world. There are many modern races still in the stage of culture which was reached by the people of Europe four or five thousand years ago. The Neolithic culture, although ancient, is still modern. It requires many thousands of years to move the whole world up a stage in civilisation.

Fig. 11.—Kits Coty House, a Megalithic monument near Maidstone.

CHAPTER II

NEOLITHIC COMMUNITIES IN CRETE, EGYPT, AND BABYLONIA

If we would understand what was happening in the East about the year 2000 B.C., when the community we have been studying in Kent was burying its dead in the dolmen at Coldrum, we must visit the island of Crete, involving a sea journey of some 2700 miles. Its white cliffs, gleaming in the sun, remind passengers on outward-bound steamers, as they coast along its southern shores, with 500 miles still to be crossed before Port Said is reached, of the white chalk cliffs of Kent, only they miss the green verdure which crowns our English coast, for at a distance Crete seems dry and barren. The island is 140 miles long, has an average width of 25 miles, and is three times the size of the county of Kent. From its backbone of hills, near the middle of the island, Mount Ida raises its crest some 8000 feet above the level of the sea. Away beyond Mount Ida, and situated on the northern shore, near the middle of the island, is its modern capital, Candia. A few miles to the east of Candia a small stream—the Kairatas—issues from a ravine in the hills, and takes a northward course of some 4½ miles across the coastal plateau to reach the sea.

In 1893 a scholarly Englishman, Arthur Evans, son of a distinguished sire, landed at Candia in search of a legendary civilisation and the fabulous Palace of Minos. By 1900 he had discovered the site of the palace hidden beneath the terraced fields on the western side of the valley or ravine where the Kairatas issues from the hills.

Season after season he returned with his army of labourers to the side of this ravine, and after twenty-three years of intrepid application and the expenditure of a fortune, he not only brought to light the Palace of Minos at Knossus, but restored to Europe the most important of all the chapters which are missing from her early history.[1]

Under the soil of the fields, where modern Cretan peasants still raise their crops, extending to a depth of over 43 feet, there was layer upon layer of refuse and soil

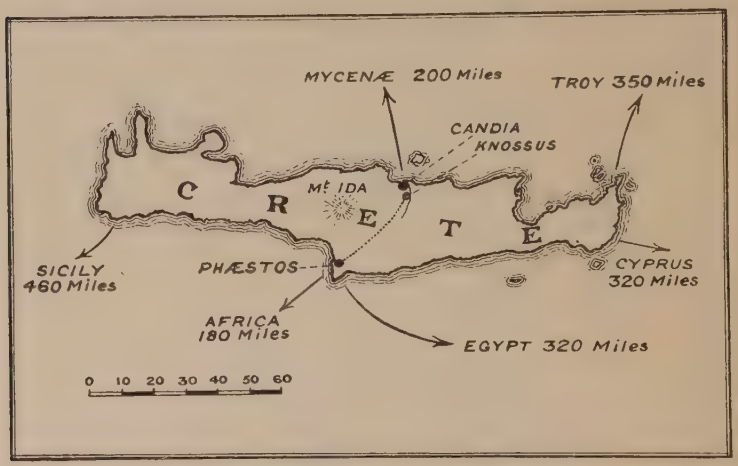

Fig. 12.—A sketch map of Crete, showing the site of Knossus.

which long-past generations of men had trampled underfoot. Every layer as it accumulated became laden with traces of the people who trod it down—sherds of household crockery, vases, ornaments, clay figures, objects of art, idols, implements of husbandry, and weapons of war. By comparing the objects found in the various strata at Knossus with others of a like kind and of known date, recovered from ruins in Ancient Egypt, Babylonia, Asia Minor, the site of Troy, and at sites in Ancient

[1] Sir Arthur Evans, *The Palace of Minos: A Comparative Account of the Successive Stages of the Early Cretan Civilisation as Illustrated by the Discoveries at Knossus.* Vol. i.: The Neolithic, Early, and Middle Minoan Ages, 1921.

Greece, Sir Arthur Evans obtained the means of estimating the length of time which has elapsed since these various layers were laid down. The series of deposits end about 1200 B.C.—a date which takes us just beyond the siege

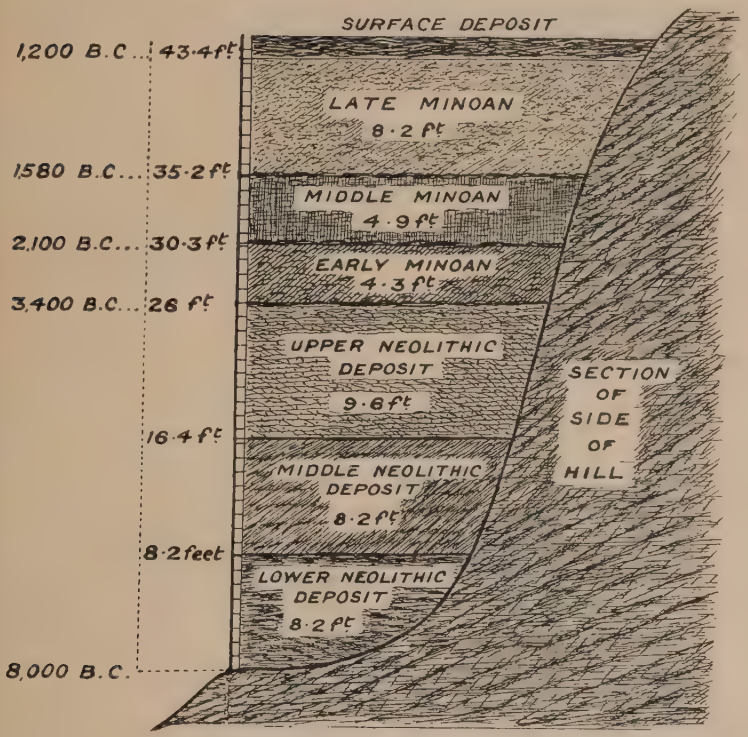

FIG. 13.—A diagrammatic section to show the various strata discovered by Sir Arthur Evans at the site of Knossus. The depths at which strata occur are given in feet, and the dates appended to the strata are those given by their discoverer.

of Troy; the Minoans had deserted by then the site of Knossus, which had been the dwelling-place of men and women during a continuous period—so Sir Arthur Evans has estimated—of about seven thousand years.

The strata which have the chief bearing on our present search are those to which their discoverer has given the name "Middle Minoan" (fig. 13). This series begins

about 2100 B.C.—approximately the same date at which the Coldrum people set up their rude Megalithic tomb. But in Crete at this date the Minoans were building palaces—great bastioned edifices, covering six acres of ground, with magnificently pillared stone staircases and corridors, paved courtyards of large size, a throne-room, and all the conveniences needed to accommodate a king and his regal court.

Under the foundations of the great palace lay strata formed during the "Early Minoan" age, covering a period of some thirteen hundred years, and carrying the history of the community of Knossus back to a date about 3400 B.C., when metals were still unknown in Crete. The Cretans of this period were still in the Neolithic age. The oldest deposits of this time were laid down in the Neolithic age, but very soon copper came into use, and towards the end bronze was introduced, so that the Cretans passed from a stone to a bronze civilisation about a thousand years before the people of England made the corresponding change. These early Minoans built houses with brick and timber walls and thatched roofs, not unlike some of the older dwellings still to be seen in the country villages of the south and east of England. They buried their dead in underground but commodious stone-built huts, shaped like bee-hives and approached by a passage; or in stone graves, shaped after the manner of a dolmen, or in rock-cut tombs after the manner of the early dynasties of Egypt. They had constructed a road from Knossus across the island to Phæstos on the southern coast of Crete, from which ships sailed the open sea to Egypt—320 miles distant—and to the ports of the Levant and Asia Minor, thus coming into touch with Babylon, to the opposite coast of Africa and to Sicily—involving a voyage across 460 miles of sea. Sir Arthur Evans has produced convincing evidence that in the fourth millennium B.C. the Mediterranean was already a highway of communication between the peoples who occupied the various lands along its shores.

We must break our survey of the discoveries at Knossus

for a moment in order to realise the bearing of what has just been noted in Crete upon the origin of the Coldrum dolmen. How are we to account for the existence of similar tombs along those North African shores which extend from Tunis to Morocco? Why are they scattered along the coasts of Spain, across France from the Mediterranean to the English Channel, along both shores of the Irish Sea, along the West Coast of Scotland, and then on to Scandinavia? Civilisation in Crete, as we have seen, was moving a thousand years ahead of that of England; with the introduction of bronze, early in the third millennium before Christ, there grew up a demand for copper and for tin. Professor W. J. Perry [1] has adduced good reasons for believing that the search for precious metals during the later part of the third millennium gives a satisfying explanation of the distribution of Megalithic tombs in these countries just mentioned, the distribution of such tombs having a close correspondence to that of ancient mines. No doubt the search for gold and precious metals urged men to undertake desperate adventures in those early times when our modern civilisation was dawning, but there is also a stronger and perhaps older impulse which sends men from their homes into foreign lands—namely, missionary zeal. Does not the distribution of these Megalithic tombs, so intimately connected with rites paid to the dead, indicate the spread of certain beliefs relating to a life after death? We shall find evidence of such beliefs as far back as we can trace the history of Neolithic man.

Having interrupted our account of the discoveries at Knossus to indicate their bearing on the history which lies behind the tomb at Coldrum, we return again to our survey in Crete to call attention to the remarkable fact that underneath the Minoan deposits there lay 26 feet of material trampled underfoot by pre-Minoans who knew

[1] Professor W. J. Perry, *Mem. and Proc. Manchester Lit. and Phil. Soc.*, 1916, vol. vi. pt. 1. See also Professor G. Elliot Smith, *The Evolution of the Rock-cut Tomb and Dolmen; Essays and Studies to Sir Wm. Ridgeway*, Cambridge, 1913.

nothing of metals. Even at the base of the deposit polished stone axes, and burned, well-finished, hand-made pottery were found, showing that the people who first settled on the site of Knossus, where long afterwards palaces were to rise, had already moved up several rungs of the ladder of Neolithic civilisation. Sir Arthur Evans holds it justifiable to assume that these Neolithic people settled at the site of Knossus about the beginning of the eighth millennium B.C. This estimate is founded on the assumption that deposits would accumulate at much the same rate during the Neolithic periods as in the Minoan age. If it took two thousand two hundred years for 17 feet of Minoan strata to accumulate, it should take some three or four thousand years to account for the growth of the 26 feet of Neolithic deposits. We shall be near the mark if we suppose that Neolithic man began to live at Knossus in the latter part of the seventh millennium B.C.

However this may be, Sir Arthur Evans found the most convincing evidence in these older deposits that the Neolithic people of Crete were already in communication with Egypt, Asia Minor, Babylonia, and Turkestan. They had seals of a design which occurs in the more ancient graves of Egypt—predynastic graves ; their stone maces and their black pottery have duplicates in Ancient Egypt and Babylon ; their clay figures or idols, caricatures in miniature of a very fat type of woman, are also found in Egypt, Mesopotamia, and Turkestan, as well as in ancient graves of Mediterranean countries to the west. Man had conquered the sea at a much earlier date than has been supposed hitherto.

The kind of men who lived in Crete during Neolithic times we have no means of telling ; their bones have not yet been found. But we have every reason to suppose that they were long-headed, dark-haired, brown-skinned members of the Mediterranean stock. In early Minoan times there was already an admixture with a round-headed type of invader from Eastern lands.

In our search for the men who first tilled the soil, kept

cattle, and thus introduced the basis of our modern way of living, we must pass from Ancient Crete to still more Ancient Egypt. At the beginning of the second millennium when Megalithic tombs were being raised in Kent and palaces in Crete, the people inhabiting the valley of the Nile, from Alexandria on the Mediterranean to Aswan at the First Cataract, a stretch of 600 miles, were living under a highly organised dynastic government. Nay, at the date of which we write, 2000 B.C., the Egyptians had already seen come and go eleven dynasties of kings. Menes, who first united the peoples of Upper and of Lower Egypt and thus founded the first of the dynasties, was certainly in power by 3300 B.C., if not earlier. The land of Egypt is but a long and narrow strip saved from the desert by the fertilising waters of the Nile. Every century 4 inches of new mud are deposited, burying and preserving records of the generations who till the fields. In Lower Egypt sherds of pottery have been found in strata which now lie 70 feet below the surface of the soil. Some day the records of Ancient Egypt which lie buried in the accumulated silt of the lower valley will be explored; in the meantime we have to depend on the records obtained from cemeteries. Throughout dynastic times, and earlier, the Egyptians buried their dead on the edge of the desert, just beyond reach of the Nile floods. The dry sands of the desert deal kindly with the dead entrusted to them. Thus it has come about that the fertile banks of the Nile, from Nubia to the Delta, are fringed by a continuous series of cemeteries belonging to every period of its history. At all times, as far back as cemeteries can carry history, the Egyptians have furnished their dead with a material outfit for a life after death, and as the nature of this outfit, as well as the fashion in tombs, has changed from dynasty to dynasty it has become possible for skilled archæologists to give dates to cemeteries and to arrange them in their order of antiquity. In 1894 Sir Wm. Flinders Petrie discovered a cemetery at Naquada, in Upper Egypt, which proved to be of a more ancient date

than the foundation of the First Dynasty of kings; it was predynastic. It contained remains of the people and of the civilisation which prevailed in Egypt before Menes united the two crowns. Thereafter predynastic cemeteries of various degrees of antiquity were discovered so that archæologists came to divide predynastic times into three periods, namely, early, middle, and late.

In 1907, before raising the height of the Aswan dam, the Government of Egypt resolved to make a survey of the antiquities and cemeteries which would become submerged when the engineers had accomplished their task. Colonel H. G. Lyons was most fortunate in the men he placed in charge of the Archæological Survey.[1] Dr G. A. Reisner, assisted and afterwards succeeded by Mr C. M. Frith, was archæologist in charge; the examination of the human remains was entrusted to Professor G. Elliot Smith, who had the assistance first of Professor F. Wood Jones, and afterwards of Professor Douglas E. Derry. It was under such circumstances that we came by a knowledge of the people who had lived in the narrow valley of the Nile, above the First Cataract, for a continuous period of at least six thousand years.

Dr Reisner came across cemeteries of all dates, but only those which belong to the predynastic age have a bearing on our present problem. He found some which were early predynastic in date, others had to be assigned to a middle period, while there were still others which just preceded the establishment of the first dynasty and were therefore named late predynastic. The late predynastic people are assigned provisionally to a period between 3300–3500 B.C.; they had learned the use of copper and were thus in a transitional stage of culture corresponding to the older phase of the Early Minoan civilisation of Crete. The late predynastic Egyptians were, as regards the evolution of their civilisation, several centuries in advance of the Early Minoans. The people of the middle

[1] The Archæological Survey of Nubia. Bulletins and Reports, accompanied by magnificent plates, were issued from time to time by the Government of Egypt between 1908–1915.

and of the early predynastic cemeteries were found to be still in a Neolithic phase of civilisation—the phase represented by the lower 26 feet of accumulated deposits at Knossus.

To see what kind of men these early predynastic Egyptians were and what manner of life they led, we may take as an example a cemetery on the left bank, numbered "79" by Dr Reisner. In this cemetery were found sixty-two graves belonging to the early predynastic period. The bodies were so well preserved that husks of barley and of millet were recovered from their stomachs. These people grew and spun flax, for their bodies were found to be wrapped in woven linen of a fine texture; they were highly skilled potters, making vessels in a number of shapes and sizes. Samples of their skill were placed in the grave for the service of the dead; they had finely wrought vessels in stone; their flint weapons and implements are of exquisite workmanship. Their women were provided with paint palettes, in slate or ivory, to be used for the embellishment of their complexions; they were given necklaces strung with beads of crystal, cornelian, or of garnet; also hair-pins and combs made of ivory; the men had stone axes and maces. Little ivory figures or idols and amulets were laid with the dead. It is clear that the people who lived in the valley of the Nile at the beginning of the fourth millennium before the birth of Christ, probably at a still earlier date, had travelled a long way up the ladder which leads from man's primitive state to that which he now enjoys. They formed settled agricultural communities and required cemeteries. The oldest cemeteries known in England are four thousand years later than those of Upper Egypt.[1]

What kind of men lived in Egypt during early predynastic times? The statement is often made, and it is one which is true in a broad sense, that the Egyptian is physically the same man to-day as he was six thousand

[1] Professor Thos. Cherry has given reasons for believing that agriculture was first practised by people of the Nile valley. *Proc. Australian Ass. for Advan. of Science*, Melbourne, 1921.

years ago. Evolution, as concerns brain and body, appears to have been stationary in Egypt. The problem as to whether or not a physical change has taken place in the Egyptians is difficult to solve for this reason. Professor C. S. Myers [1] found that as one descends the Nile valley from Aswan to Alexandria, the tint of the skin gets less dark, the head increases in dimensions, particularly as regards its width, and the face grows longer. Professor Elliot Smith [2] has found that substantially the same is true as regards the head form of the Ancient Egyptians. The predynastic men of Upper Egypt had, on an average, narrow, small heads. Were we to fit a representative skull of a predynastic man into such a frame as is shown in fig. 7 (p. 16) it would be found to fall 6 mm. short of the standard length—while in width it would fall short by 8 mm.; whereas a representative ancient skull from Lower Egypt, even of the earliest dynastic period, while it would still fall about 6 mm. short of the standard length, would almost fill the standard width. The people of Lower Egypt are distinguished from those of Upper Egypt by a greater prevalence of prominent noses and strong shelf-like chins even as early as predynastic times. Professor Elliot Smith found that the higher type of Lower Egypt was sporadically represented in Upper Egypt. It is this mixture of types which makes it so difficult to measure the degree of evolutionary change which has taken place among the natives of Egypt. As our methods improve in precision and scope and the number of our observations increases, it will probably be found that evolution has not been quiescent in that branch of the Mediterranean stock which has evolved along the valley of the Nile.

Our search along the Nile has not revealed the beginnings of Egyptian civilisation; it is said, perhaps

[1] Professor C. S. Myers, *Journ. Roy. Anthrop. Instit.*, 1905, vol. xxxv. p. 80; 1906, vol. xxxvi. p. 237; 1908, vol. xxxviii. p. 89. See also C. G. Seligman, *ibid.*, 1913, vol. xliii. p. 593.

[2] Professor G. Elliot Smith, *The Ancient Egyptians*, revised edition, 1923.

with truth, that its oldest traces are buried 70 feet deep in the deposits of the Delta.[1] However this may be, one cannot forget that in predynastic graves of Upper Egypt are found vases decorated with paintings of sea-going ships, as are other objects which indicate a very early traffic between Egypt and Mesopotamia; we must therefore pay a cursory visit to ancient Babylonia to see what bearing recent discoveries made in this land have on the problem of man's antiquity.

If we proceed from Upper Egypt to Mesopotamia in a straight line, we must cross the Red Sea and 800 miles of desert; if we take the land route, which leads through Palestine, we shall have to cover some 1350 miles; if we proceed by sea, as the predynastic people are supposed to have done, we have to make a longer voyage than that made by ships when they cross the Atlantic from Liverpool to New York. The ancient Garden of Eden—Mesopotamia—lying between the lower reaches of the Tigris and Euphrates, is a great alluvial plain which has been gradually formed and extended by mud deposited at the mouths of these great rivers. The delta of the Nile has been formed in the same way and during the same recent geological period. When this large plain was drained and irrigated, as it was in ancient days, the extent of land available for cultivation and for the support of man was three times greater than in Egypt.

We shall glance at the sites of three ancient cities of this land—cities which have long ceased to be the abode of man. We select Ur of the Chaldees first, because about the year 2000 B.C.—the date of the Coldrum tomb—Khammurabi, the Semite King, established himself in Babylon and Ur fell from its high estate. About this time, too, Abraham, accompanied by a retinue of 318 men, made his way from Ur to Canaan, involving a journey of about 1000 miles. In the present year (1924) an expedition sent out by the British Museum and the University

[1] See Professor P. E. Newberry, *Nature*, 1923, vol. cxii. p. 940; Professor J. H. Breasted, *A History of Egypt*, 1906; J. de Morgan, *L'Anthropologie*, 1921, vol. xxxi. p. 185.

of Pennsylvania to explore the site of Ur, reports the discovery of definite evidence of the foundation of the city which goes back, at the lowest estimate, to the beginning of the fourth millennium B.C.

Some 60 miles farther inland than Ur, and situated

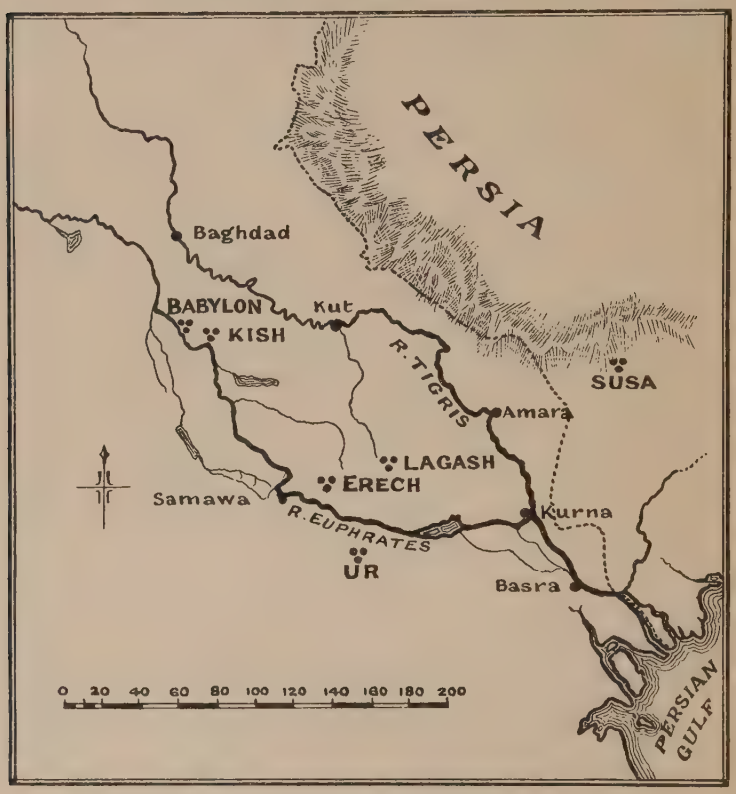

FIG. 14.—A sketch map of Ancient Mesopotamia.

between the rivers and very possibly serving as a seaport in the infancy of Babylonia, are the ruins of Erech. These ruins cover an area of 120 acres. There are records which prove that Erech is an older city than Ur of the Chaldees. Then some 90 miles farther inland, also situated between the rivers and 8 miles to the east of the ruins of Ancient Babylon, are the buried

foundations of Kish, the oldest and largest city yet discovered in Ancient Mesopotamia. Traces of the city extend over an area measuring 5 miles by 2. In the present year an excavating expedition, sent out by the Oxford and Field Museums, exposed the foundations of one of the larger buildings of Kish. Its courts were paved with a kind of brick which is known to have been in fashion at the close of the fourth millennium B.C. Underneath this ancient floor, excavations were carried out to a depth of 15 feet, but even at the lowest level reached, pottery-laden deposits were not exhausted. Nowhere in Mesopotamia have the real beginnings of its ancient cities been tapped by the explorer's spade. Copper was already in use at the lowest levels reached. It is clear that the inception of man's Neolithic way of living must lie many thousands of years behind the building of the city of Kish.

Away on the margin of the great alluvial plain, some 230 miles due east of the site of Ancient Babylon, and buried near the foot of the Persian hills, lie the ruins of the ancient Elamite city of Susa. M. J. de Morgan [1] found that people had lived here as a settled community for so great a period that the deposits which had been trampled underfoot by generation after generation formed an accumulation totalling 130 feet in depth. The upper 65 feet of strata in the mound-shaped accumulation were formed during the Copper and Bronze ages. The lower 65 feet contained flint flakes and obsidian implements ; pottery of artistic and excellent workmanship extends to the very deepest layer of the deposit. The first settlers on this site had already left the beginning of the Neolithic civilisation far behind them. M. de Morgan estimates, from the known rate at which the upper deposits accumulated, that the oldest strata must have been laid down eighteen thousand years ago. It is possible that such deposits may have grown at a greater rate than either M. de Morgan or Sir Arthur Evans have

[1] J. de Morgan, *Premières Civilisations*, Paris, 1909. See also *The Cambridge Ancient History*, vol. i., 1923.

estimated, but even if we make all allowances on this score, it is certain that the inception of Neolithic life in the East must lie some ten thousand years or more before the birth of Christ.

Before giving up our search for the exact region of the world in which agriculture was first practised, and for the kind of man who thus laid the basis of Neolithic culture, I would beg the reader to return with me once again to Upper Egypt and look westwards across the Nile from Luxor. On the other side of the river appear the hills of the desert plateau, and the barren hot valley containing the tombs of dynasties of Egyptian Pharaohs. During 1923 and 1924 Mr Howard Carter unveiled in this valley the splendour with which Tutankhamen had been buried about 1350 B.C. From these bare, sunburnt hills issues a ravine or valley, usually dry, but which, in ancient times, had been the course of a rushing river, with well-filled banks. As the water-course debouches from the plateau on the side of the Nile valley it is flanked on each side by three terraces rising one above the other. The lowest is 172 feet above the level of the adjoining reach of the Nile; the second, or middle terrace, 286 feet; while the third, or highest terrace, reaches 364 feet. These terraces of gravel represent old beds of the river which issued from the hills and plateau. The gravel beds and terraces were formed at a time when rain fell plentifully on the plateau and its hills; to-day the plateau is but part of the great desert. These terraces speak of a period, not so very remote from a geologist's point of view, when the Nile valley was submerged and was filled by a series of lakes, the waters rising at one time to the level of the highest terrace. As the land rose and the valley became drained, the middle and the lowest terraces were laid down. Even in the lowest and most recent terrace, the gravel is solidified into a hard conglomerate cliff, on the face of which are open rock-cut tombs of Ancient Egyptians. Tourists, as they enter the ravine leading to the Valley of the Kings, are familiar with these cliffs

and tombs. Here, in 1881, came General Pitt Rivers,[1] the most exact and enterprising of all British archæologists, and as he passed along the cliff-like face of the ancient terrace he observed, embedded in its substance, stone implements of the older or Palæolithic kind. Here, too, in 1914, came Dr Charles G. Seligman [2] to make a systematic search for traces of early man, and he also discovered the existence of stone implements of various types in all three terraces of the lower ravine. The gravels of these terraces, with their included tools of stone, represent the burdens which ancient rivers and torrents had washed from the surface of the plateau and had swept down their courses, ultimately depositing them on the margins of the Nile valley. On the face of the wide wastes of desert which stretch away from each side of the Nile are the courses of ancient rivers and streams; here and there, on hard surfaces exposed by eddying winds of the desert, are to be picked up various kinds of stone implements which ancient man is known to have fashioned. We have the most definite evidence [3] that there was a time when these great expanses of parched desert, which flank the Lower Nile both to the right and to the left, were green and fertile, providing an ample home for man and beast.

As to the kind of man who lived on this ancient land, now turned desert, we cannot tell, for we have found no evidence as yet. The oldest human remains so far discovered are those found in predynastic graves, with perhaps one exception. In 1922 Mr Brunton, when digging on behalf of the Egyptian Exploration Fund at Qâu,[4] on the right bank of the river, about 160 miles below Luxor, came across a strange assortment of

[1] *Journ. Anthrop. Instit.*, 1882, vol. xi. p. 390.

[2] C. G. Seligman, "The Older Palæolithic Age in Egypt," *Journ. Roy. Anthrop. Instit.*, 1921, vol. xxi. p. 115.

[3] For evidence, see C. E. P. Brooks, *The Evolution of Climates*, London, 1922; Hume and Craig, *Brit. Ass. Reports*, 1911, p. 382.

[4] On exploring this site in 1924, Sir William Flinders Petrie discovered ancient levels of human habitation. On the lower levels pottery was found and also numerous worked flints, of a late Palæolithic type.

fragmentary human bones, all of them deeply mineralised. They were apparently part of the stock-in-trade of some artisan of late dynastic times who had fashioned handles for tools out of them. Their condition is exactly that of the bones of hippopotamus and elephant found deeply embedded in the silt of the Lower Nile. Professor Douglas E. Derry [1] has given an account of their characters. They indicate the existence of a people of slender build and short stature, and although they do show minor peculiarities, must be assigned to a variety of the same stock as that to which the predynastic Egyptians belonged.

How long ago is it since the northern half of the Sahara and the whole of the Arabian Peninsula formed a green and well-watered land ? The area of this ancient land—a Pleistocene Atlantis—was equal in size and in fertility to the modern continent of Europe. Why is it that the great desert belt which crosses North Africa and the Arabian Peninsula continues to creep towards the Mediterranean and towards the Caspian ? In its march northwards there has been an ebb and flow, but the flow clearly gains on the ebb. In past times we have concentrated our attention on the flow and ebb of the ice-sheet ; it is only in recent years that it has become apparent to students that the ebb and flow of the desert belt has a closer bearing on the story of man's evolution. It was Professor Albrecht Penck [2] who first clearly recognised that as the edge of the Polar ice-sheet crept southwards over Northern Europe, the northern edge of the great desert belt of Africa and Arabia retreated towards the Equator; the climate and fertility of South Europe crossed the Mediterranean and advanced southwards almost to the heart of the Sahara ; the climate of Asia Minor passed to the deserts of Arabia. As North Europe became a desert of snow and ice, the great African desert of sand began to be covered by vegetation, and to offer

[1] A communication made to the Anatomical Society of Great Britain at Cambridge, 1923.

[2] Professor Albrecht Penck, *Scottish Geograph. Mag.*, 1914, vol. xxx. p. 281.

a home for bird, beast, and man. When the African Atlantis became again a howling wilderness of sand, North Europe became green and once more offered a home for man.[1] Those who have studied the climatic conditions which prevailed in Europe during the last geological period—the Pleistocene—which preceded the period in which we live, are of opinion that the climatic pendulum, which swings the climatic belts across Europe and North Africa, has made three complete excursions; three times the desert has become the home of man, three times it has become reduced to a waste of sand.

In our search for the men who gave the world a knowledge of agriculture and invented the culture of Neolithic times, our footsteps have been guided in this chapter to the eastern part of the desert belt. Parts of this belt have been preserved as a fit home for man by the waters of the Nile, Euphrates, and Tigris; their fertile valleys may be looked upon as rafts which have floated into our time, survivors from the wreck of a continent. The basal element in the population of Egypt and Arabia is the same; the essential Egyptian and Arab are so fashioned as to form evolutionary links between the Mediterranean type of Europe and the prevalent type amongst the natives of India. We may thus presume that the ancient Garden of Eden, which stretched from the Indian Ocean to the Atlantic, was inhabited by men of the Arab and Egyptian types.

Now geologists agree that the last Ice age in Europe was nearing its end about ten or twelve thousand years ago; they also agree that this later phase of the Ice age had

[1] These changes in climate and their cause have been very ably discussed by Mr Ellsworth Huntington, who had worked out a theory of climatic belts and the cause of their shift quite independently of Professor Penck, *Civilisation and Climate*, New York, 1915; *Principles of Human Geography* (in collaboration with Mr S. W. Cushing), New York, 1921.

My friend Professor Griffiths Taylor of Sydney University has been a pioneer in this department of knowledge. See "Climate Cycles and Evolution," *Geograph. Rev.*, 1919, vol. viii. p. 288; "Evolution and Distribution of Race, Culture, and Language," *ibid.*, 1921, vol. xi. p. 54.

See also Mr C. E. P. Brook's *The Evolution of Climate*, London, 1922.

endured for a period which is estimated to have lasted some twenty or thirty thousand years. When North Europe was in the grip of an unbroken Arctic winter, the deserts of Africa and Arabia enjoyed a temperate climate. We may, therefore, infer that from about 40,000 B.C. down to about 20,000 B.C. the people occupying these lands prospered. By 20,000 B.C. the northward swing of the desert belt had set in; and by 10,000 B.C. the flaming sword of drought had driven out or destroyed the inhabitants of these fertile lands, save such as found refuge in the valleys of the Nile, Euphrates, and Tigris, or on the fertile islands left stranded in a sea of sand. One can best explain all the facts relating to these forgotten phases of man's history by assuming that the art of agriculture and all the other arts which came to be practised in Neolithic times were already discovered by inhabitants of these ancient lands of Asia and Africa. They carried these arts with them when they were driven from their wide upland plains to the narrow confines of three river valleys. We are thus presuming that Neolithic culture is at least fifteen thousand years old, and that the men who introduced it were not unlike those of Southern Europe in size of brain and build of body. The antiquity of this human type is a problem to which we shall refer again.

In the next chapter we must return to England and seek to trace the history of its inhabitants towards the night of the Ice age, but while we are carrying out this part of our search we must ever keep in mind the happier conditions which prevailed in those lands which lie to the south and to the south-east of Europe, lands now reduced to wastes of sand and rocky desert. The home of the European type of man and the cradle of his civilisation lie in that part of the world where Asia merges into Africa.

CHAPTER III

THE PEOPLE OF THE SUBMERGED FOREST

The Megalithic monuments and the people who built them belong to the closing phases of the Neolithic period. We are now to seek traces of the people who lived in England towards the commencement of that period. The records of the time are not beyond recall, for we now know that large tracts of country over which the early Neolithic people roamed and hunted, perhaps established their village communities and, in all likelihood, cultivated their little plots of ground, are preserved beneath the waters of surrounding seas. At various parts of the English coast a low tide exposes the fringes of these Neolithic territories along the foreshore. The old land surfaces are easily recognised when they are marked, as is the case in some localities, by the blackened stumps of trees, still rooted to the soil on which they flourished long ago. Remnants of these submerged forests are to be seen along the West, South, and East coasts of England, round the Channel Islands, and along the North-West coast of France. They extend far out into the bed of the North Sea. The Dogger Bank (see Mr Clement Reid's map, fig. 15), now covered by 60 feet of water at low tide, still yields, when dredged, peat and the remains of the marsh-plants which once grew where now great steamers come and go. Even at greater depths—at levels which lie 120–130 feet below the surface of the sea—the same evidences of an old land surface are to be found.[1] Mr Clement Reid

[1] See the late Mr Clement Reid's excellent manual on *Submerged Forests*, Cambridge University Press, 1913.

has studied the plants which grew on the Dogger Bank when it formed part of Continental England, and in his opinion they are modern in character. They represent living species, of the kind which favour a moderate climate and marshy surroundings. My friend, Mr J. Sinel,[1] has studied the submerged forests off the coasts of Jersey. He has traced the old land surface, on which the forest grew, right out into the English Channel, until a depth of 140 feet is reached. When that land surface was in existence, it is highly probable, as already stated, England was joined to the continent of Europe. Now, at various places and at various times, worked flints have been discovered on and under this old land surface. They have always been worked in the style adopted by the men of the Neolithic period. The remains of the animals which have been unearthed at the "submerged-forest" level are those of beasts which are known to belong to the Neolithic period.

The Neolithic territories which lie deep beneath the sea are beyond our reach; at some future and far-distant period, perhaps, they may again become dry land and afford the anthropologists of the time ample means of studying some of their Neolithic ancestors, whose bones, no doubt, lie preserved there for all time. Fortunately for us, there are certain marginal corners of the submerged-forest land within our reach. As the sea crept upon the land at so slow a rate, we must suppose that its gain was not apparent in the lifetime of a generation. The estuaries of the sea invaded our river valleys. The estuary of the Thames, for instance, before the subsidence of the Neolithic period began, was far out in the North Sea; London, we must presume, lay far above the tidal limit (fig. 15). In the course of time, as subsidence proceeded, the meadows and woodlands lying along the bottom of the valley became submerged in times of flood. Every flood or high tide left a veneer of slime behind, coating the floor of the valley and turning forest and meadow land into marsh. In the course of centuries,

[1] *Prehistoric Times and Men of the Channel Islands*, Jersey, 1914.

the marsh became a slimy expanse of mud, and the old land surface became buried under many feet of alluvial deposit or river sediment. That such has been the

Fig. 15.—The land-connection between England and the Continent in early Neolithic times (Mr Clement Reid).

recent history of the Thames valley we have the most ample evidence. Some time ago a trench, over 100 yards wide, a mile in length and 40 feet in depth, was cut across the marshland of the Thames valley to form a new dock for London (see fig. 1). Along the whole length of the exposed sides of the trench—about

30 feet below the marsh level—could be traced a thick layer of peat, strewn with the trunks of great trees, all of them uprooted; not one was to be seen standing as it grew on the ancient land surface. They represent, we suppose, the crop of trees which flourished when the backwaters of the Thames first invaded the forests which grew on its banks. Below the marsh deposit and the peat is a thick stratum of ballast gravel — water-rolled stones, many of which are of considerable size, deposited in the river bed when the Thames was a powerful, rapid stream. In places, the ballast gravel is so thick that its deepest layer lies 60 or 80 feet below the present bed of the river. The bottom layer of the ballast gravel marks the time when the land had reached its highest point of elevation, and the estuary of the river reached its farthest limit in the North Sea.

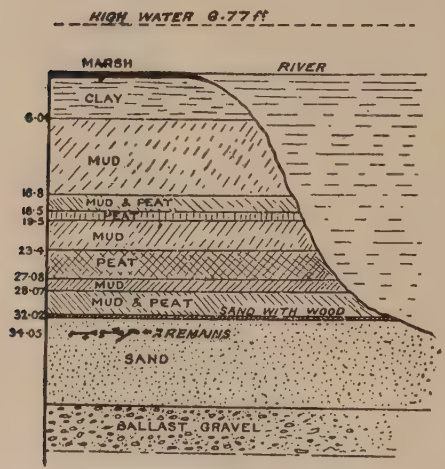

FIG. 16. — Diagram to show the various strata which buried the old land surface and the human skeleton at Tilbury.

The trench just described gives us a section across the floor of the valley of the Thames, five miles below the central part of London. To ascertain the kind of people who lived in England when the old land surface was clad with a flourishing forest, we have to go down the river still further, to Tilbury docks, situated on the marshland on the north bank of the river, twenty miles below London. When these docks were being made in 1883, the old land surface—the Neolithic valley bottom—was met with at a depth of 32 feet below the level of the marsh, 36½ feet below the limit reached by the water at

high tide. Three feet beneath that old land surface was found the skeleton of the Tilbury man. When a complete skeleton, or rather, representative parts of a complete skeleton, are found together, it is almost certain the person to whom that skeleton belonged was buried by human hands.

It could happen that the entire body of an individual might come to rest in a deep, quiet, muddy pool, and thus become naturally entombed, but in the bed

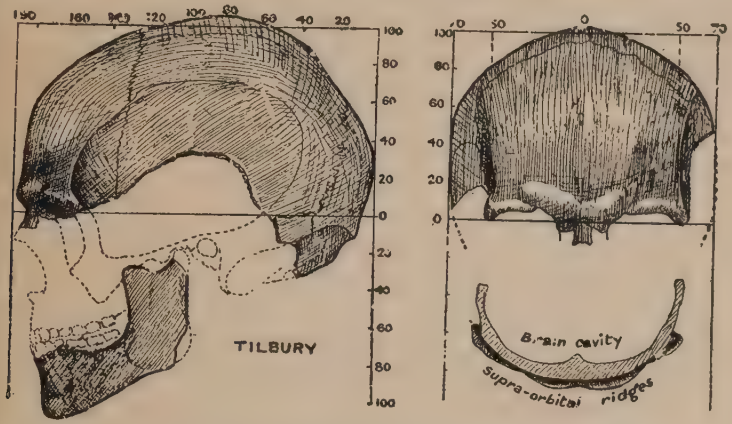

FIG. 17.—The Tilbury skull fitted within the standard frame for modern British skulls of average size.

of a quick-flowing river, such as the Thames then was, this fate is improbable. As decay set in, the various parts of the body would become dismembered and scattered. We may reasonably presume, when a complete human skeleton is found, that we have to do with a burial. In 1883, when the Tilbury remains were found, men were not on the alert for the evidence which might have confirmed such a supposition; no one expected to find "buried" human remains at such a depth. By the fortunate find at Tilbury, an Englishman of the submerged-forest age was revealed to us. When the skull is placed within the frame which fits the head of the average modern Englishman, it is seen that the

ancient man of Tilbury reaches our modern standard. There is no feature of his head which marks him off from his successors of to-day. Like the people of Coldrum, he has a skull of the river-bed type. In brain capacity he is the equal of the average man of to-day, his capacity being just under 1500 c.c. In height he was about the same as the Coldrum men—about 5 feet 4 inches (1·630 m.). He has the same flattening of the thigh and leg bones as is to be seen in them. The skeleton lay 3 feet below the old land surface, laid to rest there, we presume, by the hands of his comrades. Neither he nor they could ever have dreamed of the day when great steamers would sail over the land which was their home. Such worked flints and animal remains as have been found, indicate that the old land surface—the submerged-forest surface—was inhabited at an early part of the Neolithic period.

Can we form any reasonable estimate of the centuries which have passed since the Tilbury man lived ? When the Tilbury docks were being cut, it was noted that an old land surface, " strewn with Roman refuse," lay about 7 feet below the present surface level. At first sight this observation seems to show that the land surface at Tilbury had sunk 7 feet since the Roman occupation of England ended some fifteen centuries ago. The ford by which the Romans crossed the Medway at Rochester, and the road which led to the ford, are now about 8 feet below the level of mean tides. The borough surveyor of Rochester is of opinion that there has been a subsidence of about 8 feet since the Romans used the ford. If the subsidence of the Thames valley had proceeded at an equal rate, century after century, then the antiquity of the Tilbury man could be easily estimated. If it has taken fifteen hundred years for the Roman surface to sink 8 feet, then we may infer that it has taken six thousand seven hundred years for the land surface on which Neolithic man lived to subside to a depth of 36 feet below high-water level. If this estimate could be relied on we should have to give the Tilbury

man an antiquity greater than that assignable to any predynastic Egyptian.

It is clear that if the process of subsidence is not continuous, but takes place at irregular intervals, with upward as well as downward movements, our calculations may be seriously upset. Besides the deepest old-land surface represented by the submerged-forest zone, there may occur, in the submerged-land deposits, other two zones of peat or vegetable matter, which seem to indicate two later stationary periods—intervals in which subsidence did not occur, or took place very slowly.[1]

The lowest layer of peat was formed above the land surface on which Tilbury man lived (fig. 16). Now, in other parts of England peat is formed at the same horizon and is found to contain Neolithic implements which are assignable to a date about the end of the fourth millennium B.C., the time at which dynastic rule was first established in Egypt. The middle stratum of peat, seen in section at Tilbury (fig. 16), probably represents the layer formed in late Neolithic and early Bronze times, about the end of the third millennium B.C., while the upper stratum is a growth of pre-Roman times.

A discovery made on the flat coast of Essex, at Walton-on-Naze, fifty miles from Tilbury as the crow flies, throws some light on the antiquity of Tilbury man. The tide here beats against a bank of rain-washed clay 10 feet in thickness, exposing at its base an old land surface. Every high tide exposes more and more of this surface, strewing the beach with débris washed out from it—including finely worked Neolithic flints and fragments of pottery. On a September afternoon of 1910 Mr Hazzeldine Warren and his companion, Mr Miller Christy, while searching the beach for washed-out flints, were surprised to see the bones of a human leg exposed on the face of the beach 2 feet below the prehistoric level and 12 feet beneath the present land surface. They set to work and exposed a complete skeleton,

[1] W. H. Cook, "Alleged Depression of the Land in South-East England in post-Roman Times," *Medway Scientific Research Soc.*, 1914.

which lay on its left side, with arms folded on the breast, knees bent and thighs flexed close against the body. An examination of the state of the bones and its position in the bank showed that this "crouched" burial had been made by the people who lived on the old land surface and worked the Neolithic flints. The skeleton proved to be that of a young, well-built woman, 5 feet 4 inches in height, with a rather small but finely proportioned head, a face with regular features, a somewhat prominent nose and well-formed chin.[1] All her teeth were sound and regular, being set on a well-spread palate. Her skull was 176 mm. long, 137 mm. wide, the width being 76 per cent. of the length. Her cranial dimensions are those which are still prevalent among English women. Amongst her ribs was found a heap—nearly a pint—of the seeds of the wild blackberry and dog-rose, but whether these represented a last meal, or a store provided by relatives for her journey after death, one cannot tell. Clearly she died in the autumn of the year. As to the period at which she lived there can be little doubt. The kind of flint tools and the fragments of pottery—of an early "beaker type"—are those common in England about 2000 B.C.

Is this land surface exposed by the tide at Walton-on-Naze the same as the one that contractors laid bare at Tilbury? Mr Hazzeldine Warren is of opinion it may well be the same, for if we suppose that the Tilbury man was buried just above the level of high tide and that the Walton-on-Naze woman had been buried in a part of the land which lay 36 feet above high-water level, then if the land subsided 36 feet, or if the level of the sea had risen this amount, the skeletons would have reached the levels of the respective strata at which they were found. Beyond doubt Tilbury man and Walton-on-Naze woman belong to the same racial type. Yet I think it will be found that Tilbury man belongs to the level of the older peat and may be placed at a date of about 3000 B.C.

[1] For fuller details, see *Ancient Types of Man*, 1911.

An attempt to fix the antiquity of Tilbury man brings us face to face with a problem which will beset us all through this book—the instability of land and sea. The elevations and depressions of the land have to serve us as geological milestones as we follow man's history into the remote past. It is difficult to realise that England is not founded on a rigid, solid, and fixed part of the earth's crust. We build our seaports, harbours, docks, railways, roads, and cities in the firm belief that the level of the sea on our shores will not alter. Our experience of the last eight hundred years seems to justify our trust. There is no gainsaying the fact, however, that the southern part of England has sunk at least 36 feet since the days of Tilbury man, which may be no more than five thousand years ago.

The position of Tilbury man in the Neolithic scale of time may be approached from another point of view. From evidence obtained from glacial deposits in Sweden, it is estimated that the edge of the ice-sheet on its retreat northwards had reached the latitude of Stockholm about 8000 B.C. As the ice-sheet was in these last stages of its retreat, a people appeared in Western and North-Western Europe who shaped their stone weapons in the earliest of the new or Neolithic style, one which gradually replaced the last of the older or Palæolithic fashions. About the time at which this transition of fashion in flint tools occurred, the southern part of England stood 100 feet above its present level, and the Thames at Tilbury occupied a channel at least 70 feet deeper than its present one—the estuary of the river lying far out in the North Sea. From the ballast gravel which fills the buried Neolithic channel of the Thames Mr Frank Corner has gathered flint weapons worked in the earliest Neolithic manner. We have therefore in the lower valley of the Thames Neolithic deposits ranging over a period of about six thousand years—from 8000 B.C. to about 2000 B.C. If, then, we regard the Tilbury man as a sample of the men who occupied the Thames valley towards the end of the Neolithic period, we have still to find the men who lived

in it during the earlier phases of this period. We therefore set forward in our search.

The records of the Neolithic period which we have just deciphered at Tilbury are not confined to the lower valley of the Thames. When we cross the English Channel we find that contemporary deposits were accumulating in the Island of Jersey. We meet with traces of the same men, the same Neolithic culture, the same evidence of subsidence. As the steamer carries us along the south coast of the island in the early morning, past the rocky cliffs on the left, where remains of Neanderthal man were discovered by Dr Marett in 1910, we come presently in sight of the capital town, St Helier, descending from the uplands of the plateau to extend itself on the low-lying lands surrounding the harbour. Near the harbour are the offices and the museum of the Société Jersiaise, a centre of prehistoric research. The Jersey Society has devoted particular attention to the Megalithic monuments and other records of the Neolithic period in which the island is particularly rich. Among its members no one has given his time and ability to the study of this period with greater success than the curator of the museum, Mr J. Sinel.[1] We propose to follow him to a deep excavation which was made for the foundation of a new building in the lower part of the town. Mr Sinel's diagram (fig. 18) shows the various strata which were cut through ; they have a certain degree of correspondence with the section at Tilbury. Beneath the surface layer of sand and clay, about 4 feet deep, is a layer of peat, containing fragments of pottery of the Roman period. That layer of peat was a "land surface" in Roman times. Beneath the peat comes a stratum laid down by the sea—made up of clay, containing stones and shells. That stratum bespeaks a passing period of subsidence, which might have occurred at Tilbury and left no trace behind. Then, beneath the marine stratum, comes the submerged-forest zone, here represented by a layer of vegetable débris—of oak, alder, hazel, etc.—

[1] See reference, p. 42.

ranging in thickness from 5 to 14 feet. So great an accumulation shows how long the forest age must have flourished here. Beneath the forest zone comes another sea deposit, a stratum of marine clay, sand, and shells, 3 to 5 feet in thickness, indicating a period of subsidence prior to the forest age. This zone may represent a deposit contemporary with the ballast gravel. Beneath the marine deposit comes one of clay with stones —rubble drift — a mark of the colder or glacial period. It was known, when this excavation was made in St Helier, that flints, pottery, and remains of animals of the Neolithic period occurred in the great bed of peat representing the forest period. Mr Sinel observed these traces of Neolithic man, not only at various depths of the peat zone, but also in the upper part of the marine deposit. The marine deposit formed the land surface on which the submerged forest first grew. Men of the Neolithic culture were thus in Jersey at the very commencement of the forest era. The ancient forest land surface can be traced to the coast of France and far into the English Channel—to a depth, according to the observations of Mr Sinel, of 140 feet. In the earlier part of the Neolithic period, Jersey and Guernsey—all the Channel Islands—were, like England, joined to the Continent.

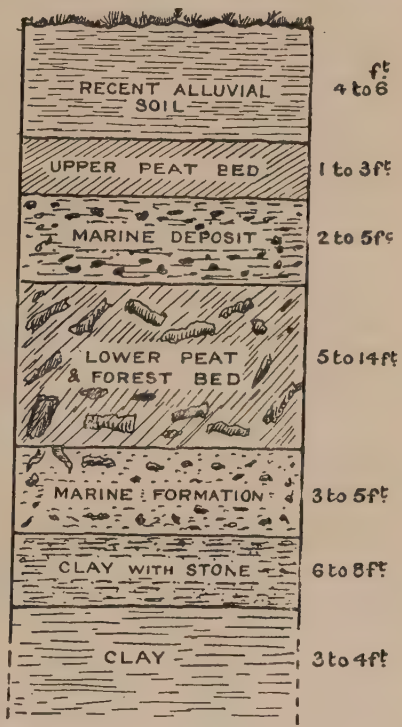

FIG. 18.—Section of the deposits exposed in a site at St Helier, Jersey (J. Sinel).

When we come to measure the antiquity of that time, we must keep in mind the width and depth of the English Channel and of the Straits of Dover. They were carved out of Neolithic lands. It is twenty-two miles from Dover to Calais and we cross water over 200 feet in depth. When we suppose such changes have happened in eight thousand or ten thousand years, we seem to set Time, with all the forces she can command, a task beyond her power.

The fortune which attended the sinking of the docks at Tilbury did not follow the excavation in St Helier. Mr Sinel discovered remains of a Neolithic man neither in nor below the forest zone; but in a small island—La Motte, or the green island—on the south coast of Jersey and three miles to the east of St Helier, remains of Neolithic man were found. Dr R. R. Marett has given a full account of this discovery.[1] At no very distant period La Motte had formed a small peninsula, but now its connection with the shore is broken, and it is accessible on foot only when the tide is out. At high-water the waves beat round the base of the island—it is so small that its final demolition is almost in sight—wearing away its substance and exposing to full view an exact section of its strata. The islet rises 30 feet above high-water mark. No sign is to be seen of the forest zone, but the yellow clay—a glacial deposit—on which the forest bed should rest forms the basis of the islet. Over the basal 15 feet of yellow clay lies a stratum of sand and clay—a loess—4 feet in thickness. Above that, and forming the surface stratum, is a layer of blown sand covered with vegetation. Below the blown sand lies the surface on which Neolithic man lived, for here are abundant remains of a "kitchen-midden"—charcoal, bones of ox, pig, red deer, shells of limpets, fragments of Neolithic pottery, and abundance of flint chips. In 1911 a landslide from the side of the island exposed a fresh section, in which Mr Sinel's son detected the projecting ends of a stone cist. It did not lie at the level of the kitchen-midden, but 4 feet

[1] "Further Observations on Prehistoric Man in Jersey," *Archæologia*, 1912, vol. lxiii. p. 203.

deeper, at the junction of the loess with the glacial clay. A careful exploration, undertaken by the Société Jersiaise, showed that there was a series of stone cists placed side by side, underlying the stratum of loess. The cists were filled with clay, from which Mr Sinel, by exercising great care, was able to remove some of the remains of the people who had been buried in these Neolithic tombs. He was able to restore, from fragments, three of the skulls. To me it seems reasonable to suppose that the people buried in these cists were members of

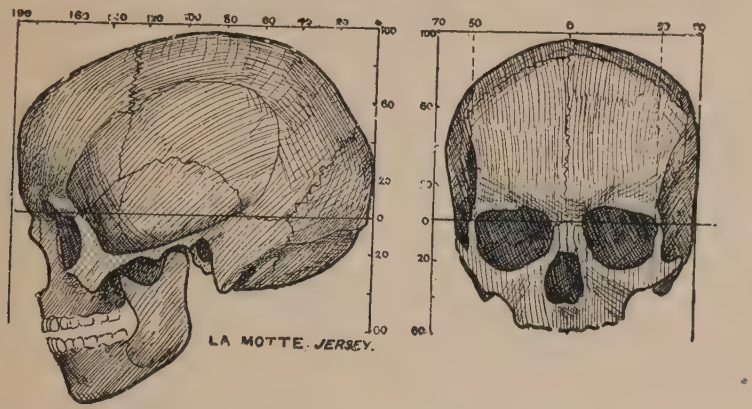

FIG. 19.—Skull of a woman, from a Neolithic cist, La Motte, Jersey.

the community who occupied the site of the kitchen-midden. At a much earlier period—1861—a skull was found in La Motte. It lay within the glacial deposit, at a depth of 18 or 20 feet below the surface of the island. This skull is exactly similar in type to those recovered from the cists, and it is safest to presume that it reached the depth at which it was found in a fall of earth from the level of the tombs.

On the occasion of a visit to Jersey, some years ago, I had an opportunity of making a close examination of the skulls from the cists at La Motte.[1] All are of the river-bed type. In fig. 19 I have placed one of them—that of a woman, aged about thirty—within the standard

[1] See *Bulletin de la Société Jersiaise*, 1913, vol. xxxviii. p. 306.

frame of lines employed in the case of other Neolithic skulls. In size and shape the Jersey specimen differs very little from the skull from the monument at Coldrum, represented in fig. 4 (p. 10). In the Neolithic period, that human stock, to which the name "Mediterranean" has been given, had reached Jersey as well as England. In the early part of the Neolithic period the people with the river-bed type of head could reach both Jersey and England by land.

We are now to recross the English Channel to take up the study of Neolithic man in Cornwall—the extreme south-west corner of England. Jersey and Cornwall have much in common. On the uplands of both, Megalithic monuments of the Neolithic period abound. Beneath the blown sand of the "links" occur, as at Harlyn Bay, the same serried cist tombs, the same Neolithic kitchen-middens.[1] On the foreshore of Cornwall, as of Jersey, we can see at low tide remnants of the same ancient land surface, marked by the peat-stained stumps of the trees of the submerged forest. In Cornwall, remains of the men who lived on that ancient land surface have been found. In their day the cliffs of Cornwall overlooked wooded plains where now coasting steamers come and go. The submerged forest is not confined to the foreshore of Cornwall. It creeps up the estuaries of the streams which drain the tin-producing hills of the inlands. In those estuaries of the Cornish coast, the submerged forest lies buried, as in the valley of the lower Thames, beneath 30 to 50 feet of deposits laid down by the streams as the land sank and the invading sea crept inland. The submerged forest in the Thames valley grew on the "ballast-gravel" bed of the Thames. In the Cornish estuaries the submerged forest rests on a corresponding deposit laid down in the original or deepest bed of the streams. The Cornish streams, in ancient times, brought from the weathered granite of

[1] In 1917 I had an opportunity of examining the flagstone graves at Harlyn Bay, and the remains contained in them. Although covered by blown sand, they are of late Celtic date.

the hills, not only the débris but also tin ore, which came to rest in the bottom stratum of the valleys and estuaries.

To the student of ancient man, this proved a fortunate circumstance, for the tin miners had frequently to expose and explore the old forest bed overlying the tin-producing stratum. In the museum of the Royal College of Surgeons of England there is the roof and sides of a skull from the horizon of the Cornish submerged forest. It was found in 1809, at a depth of 36 feet, in the Carnon Stream Tin Works, which were, for these river-bed workings came to an end nearly a

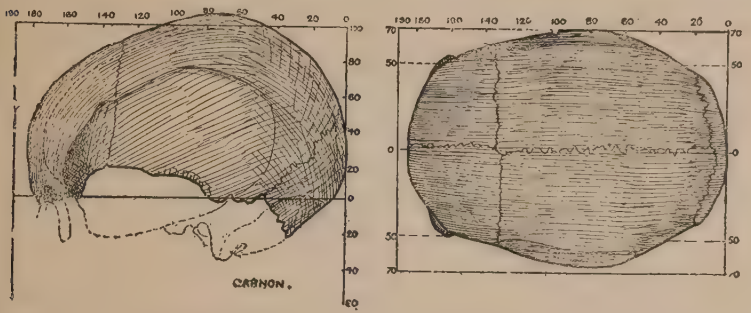

FIG. 20.—Views of the Carnon calvaria, from the side and from above.

century ago, situated on a western branch of that inlet of the sea which pierces Cornwall at Falmouth. Fortunately, we have a record of the strata exposed at the Carnon Works in 1807—two years before the skull was discovered, the record being made by Mr Edward Smith.[1] The strata lying over the skull-containing layer, our enumeration beginning from the surface, were the following: (1) mud and sand, 7 feet; (2) granitic gravel, shells with traces of charcoal, 4 feet; (3) fine gravel, mud, and shells, 12 feet; (4) another thick stratum of gravel, sand, and shells, 19 feet; making 42 feet in all. Just below the last-mentioned stratum were found human skulls, and a piece of wood evidently shaped by man. The skulls

[1] See *Memoirs of the Geological Survey: Geology of Falmouth and Truro*, 1906.

lay immediately on the tin-producing stratum, and are therefore as old or older than the submerged forest. What became of the skulls mentioned by Mr Smith is not known. The specimen in the College of Surgeons may be one of them, but the record which has come down with it is that it was found in 1809, two years after the date at which Mr Smith's account was written, and the depth at which it was found is said to be, not 42 feet, but 36 feet. The condition of preservation or fossilisation of the Carnon skull is remarkable. Although that of a comparatively young person, as we may see from the open conditions of the sutures between the bones, and the characters show it is a woman's skull, yet it is very heavy and rather thicker than we expect in modern skulls of young people, even of the male sex. It is 8 mm. thick along the roof. The colour is a dull stone-grey, as if impregnated with some unusual substance, not black as are skulls which have been buried in peat. In size and shape the Carnon skull or calvaria shows all the river-bed characters. The maximum length is 184 mm.; its maximum width 137 mm.; the height above the ear-holes is estimated to have been 117 or 118 mm. The width is 74·5 per cent. of the length; the brain capacity must have been about 1380 c.c.—slightly above the average for modern women.

An accurate record of another of these Cornish Neolithic skulls has been preserved by one of the best English anthropologists of the mid-Victorian era—Mr George Busk. In 1862, Mr Busk gave an account of the famous Neanderthal skull discovered in 1857.[1] He also gave accurate drawings of certain other ancient skulls. Amongst these he included one from an alluvial tin mine at Sennen, close to Land's End. The skull was found at a depth of 30 feet. That is all we know of the Sennen skull, except that it was found beneath the level of the sea. Where that skull is now we do not know—probably destroyed, so careless are we of our records of ancient history. There can be no reasonable doubt, however,

[1] *Natural Hist. Rev.*, 1861, vol. i. p. 155.

that the Sennen skull also comes from the submerged-forest zone. Mr Busk's drawing of the skull I have copied and reproduced here. He does not, unfortunately, represent it either from above or from the front. The skull is that of a man. Its maximum length is 196 mm., somewhat longer than is usually the case in the river-bed type. The height of the vault is 116 mm. above the ear-holes. In all its markings it is modern in shape and

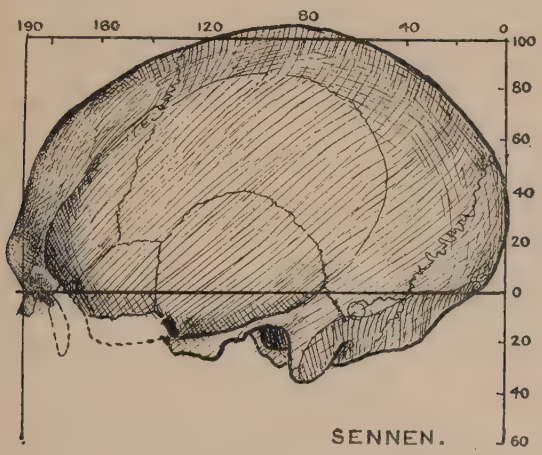

FIG. 21.—Side view of a skull found at a depth of 30 feet in an alluvial tin mine at Sennen, Cornwall.

size. There are thousands of men in England to-day with skulls of the same size and form.

We owe many of the discoveries of ancient man to industrial enterprises. The mining operations of the Cornish engineers brought them face to face with the records of the Neolithic period; house-builders revealed the submerged forest and Neolithic flints in the foundations of St Helier; Tilbury man came to light because deep docks were needed for great steamships. Along the south coast of Wales, which forms the northern shore of the Bristol Channel, the dock engineer has brought traces of the submerged forest and of Neolithic man to the light of day. It is to this region we are now

directing our steps. At various points along the coast of South Wales, as on the opposite or southern side of the Bristol Channel, remnants of the submerged forest are exposed when the tide is low, especially after a storm. At various points along the coast, docks have been cut and the land surfaces of Neolithic times exposed. There seems to be no doubt that subsidence has been in progress along this coast since the Roman period. Major Thomas Gray has supplied me with evidence that the land has sunk at least 8 feet, perhaps more, since the Roman occupation—quite as much as at Tilbury and Rochester on the east side of England. Some years ago, Dr Arnalt Jones presented to the museum of the Royal College of Surgeons the frontal part of a skull which was found when docks were being made at Aberavon on the South Welsh coast, a few miles east of Swansea. This fragment came from a submerged layer of peat. Side by side with it was the pelvis of the great Irish deer or elk, which became extinct in England before the end of the Neolithic period. The layer of peat, 2½ feet thick, lay at a depth of 15 feet, beneath strata of sand and clay. The peat may represent the submerged-forest zone, or one of the later land surfaces. At least it belongs to the Neolithic period. This case is of some interest because it raises the question: Is a fragment of a skull, such as that found at Aberavon (fig. 22), sufficient to indicate the kind of man of which it formed a part? The fragment, consisting of the frontal bone, forming the forehead, and a small part of the parietal bone, forming the vault, is shown in fig. 22. It has been superimposed on the outline of another skull—one found at Newport—also of Neolithic date. It fits that skull not quite accurately, but sufficiently well to show that it was part of a skull of similar shape, although of rather larger dimensions. We are therefore at liberty to infer that it formed part of a skull very similar to the usual type of Neolithic crania. The Aberavon fragment, however, has certain characters which deserve attention. The eyebrow ridges are particularly well developed; it shows a robustness in

the lines of attachment of the temporal muscles which is not usual in modern skulls. Major Gray has also given me the opportunity of examining a skull dredged in 1840 from the same peat deposit as the Aberavon fragment came from. This is a complete specimen, and, in the frontal region, is a counterpart of the fragment just described.

In all these finds of Neolithic man in England, the reader will note an unfortunate deficiency; there is a complete absence of any record of the culture of the people; in not one single case is the discovery mentioned

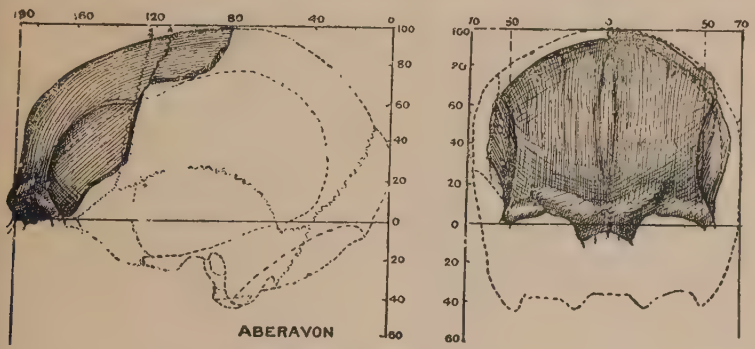

FIG. 22.—Fragment of skull found at Aberavon, superimposed on an outline of the Newport skull.

of a typical example of a Neolithic implement or of even a flint chip. That is because we are only now awakening to the kind of evidence which is required to give our discoveries a true value as historical documents. The need of such evidence is exemplified in the next discovery I am to mention—one made when new docks were constructed at Newport, which lies also on the south coast of Wales, almost on the estuary of the Severn. Mr J. D. C. Couper, the resident engineer, made most careful records of the sections which were cut in the alluvial deposits at the mouth of the Ebbw, covering the old submerged-forest zone. The excavations exposed a deep layer of silt or mud overlying an equally deep layer of gravel. Lying within the gravel, at a depth of 60 feet

below the surface level of the land and 20 feet below the Ordnance datum level, was found a human skull ; [1] also remains of the wolf, of the red deer, the pelvis of a large ox (curiously ground and polished on one aspect, as if it had been used as a sledge on ice), of the horse, all being mammals which flourished in Neolithic times. These were found at the same level, or near the same level, as the human skull. Worked flints were also found, but, unfortunately, no record was kept of them. We are thus not certain that the skull found is that of Neolithic man ; the evidence, however, does justify us in presuming that

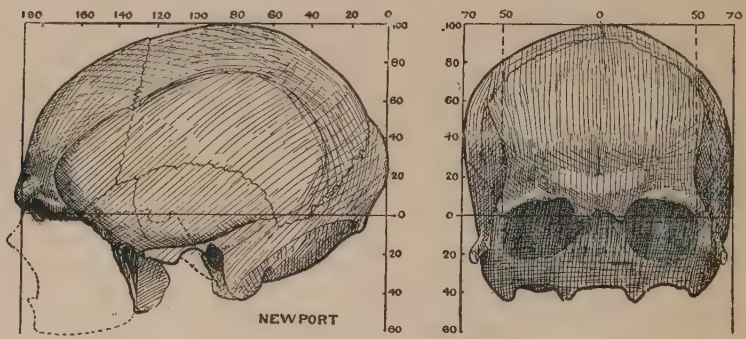

FIG. 23.—Side and full-face views of the skull found during excavations at Newport.

it is of that date. The outlines of the skull are given in fig. 23, and again it will be seen we have to deal with a man's skull of the type we have already seen from other Neolithic horizons.

It is not necessary to multiply such examples. I may refer, however, to a skull [2] which was discovered when the Manchester Ship Canal was being made in 1890. It lay in a deposit of fine, sharp sand, covered by silt and other strata, amounting to 27 feet. No record was made of any objects of culture found in the same stratum as the skull. Sir Aubrey Strahan, who has investigated the geology of the district in which the skull was found, is

[1] See Reports of Newport Museum, 1911.

[2] Now in the museum of the Royal College of Surgeons, England.

of opinion that the deposits which lay over this skull may have been formed in the last two thousand years, and that a skull found at such a depth may not be Neolithic. In characters the skull agrees absolutely with the river-bed type. Another skull of this type was shown to me by Mr Robert Newstead, curator of the museum at Chester. The skeleton of which it formed part lay at a depth of 5 feet 3 inches, in a clay deposit in the valley of the Dee, near Chester. The skeleton is certainly older than the Roman period, for, at a depth of 1 foot in the clay, pottery of that period was found. The

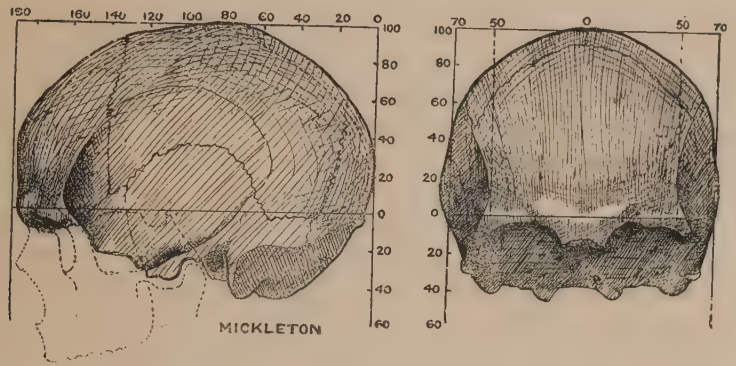

FIG. 24.—The Mickleton skull, side and front.

exact age of the remains cannot now be fixed; evidence for regarding them as Neolithic is merely presumptive.

In this group of doubtful early Neolithic English skulls recovered from the river-bed deposits, we must place the "Mickleton" skull, one which gave rise to much discussion in pre-Darwinian days. In 1852, the railway from Oxford to Worcester was being made. It crossed the Cotswold Hills in the northern part of Gloucestershire, where a tunnel had to be cut, near the village of Mickleton. During the excavations at one end of the tunnel a human skull was found, now preserved in the museum of the Royal College of Surgeons. The skull lay 17 feet beneath the surface of the land, within a stratum of blue clay, 5 feet in thickness. Over the clay was a layer of

peat, 9½ feet in thickness, containing remains of pig, fox, etc. Over the peat was a surface stratum, 3 feet in depth, made up of loam, sand, and gravel. The date of the discovery is 1852. Darwin had not then published the *Origin of Species* (1859), but the *Vestiges of Creation* was passing into a tenth edition. Orthodox minds were being disturbed by the discovery of facts which seemed to be at variance with Biblical tradition. The antiquity of the Mickleton skull [1] became a matter of public controversy. A learned Scottish clergyman publicly censured Professor Baden Powell of Oxford University for countenancing a "pre-Adamite" date for the Mickleton skull.[2] Mr Gavey, who discovered the Mickleton specimen, was of opinion that the age of the deposit was clearly indicated by the presence of a human skull: the deposit could not be earlier than the historical date assigned to the act of man's creation. In Mr Gavey's opinion, the skull of this reputed "pre-Adamite" was probably that of a "drunken sheep-stealer, drowned in the bottom of a hill pond, in all likelihood not more than eighteen hundred years ago." There is something to be said for Mr Gavey's contention. The layer of clay in which the skull rested is the silt formed in the bottom of a hill pool; the deep layer of peat, 9½ feet thick, may have formed over the silt in a thousand years, and the superficial stratum, 3 feet in thickness, at a rapid pace. The animal remains found in the peat may be Neolithic or mediæval in date. The value of worked flints as a means of dating a deposit was then unknown; no evidence of this kind was looked for. The Mickleton skull is a typical example of the river-bed type, and the manner in which it has been preserved provides an excellent illustration of how the earth records its own history and stores within itself traces of the living things which inhabit it.

Our survey of the Neolithic period in England reveals a remarkably uniform and unchanging race of people—of less than medium stature, with well-shaped heads of rather

[1] *Edinburgh New Philosophical Journ.*, 1856, vol. iii. p. 247.
[2] *Quart. Journ. of Geol.*, 1853, vol. ix. p. 29.

more than average size. If we centre our attention merely on the physique of the people and note how little it changes, we may be led to the belief, if we think our bodily characters must change during the lapse of long periods, that the Neolithic period in England could not have covered the great space of time we have assigned to it—namely, from 8000 to 2000 B.C. The animals which accompanied man in this period also changed very little ; the natural plants of the country remained the same. Such changes as are noted in the fauna and flora are, we have every reason to think, due to the direct influence of man. In the four thousand years which have come and gone since the Neolithic period closed, we have revolutionised the conditions of life. From time to time, fresh blood, drawn from many racial stocks, has been introduced into Britain ; the tongue spoken in England has changed several times, yet the backbone of the British population at the present time is a direct continuation and perpetuation of the river-bed stock of the Neolithic period.

If we reckon time by the degree of change wrought on the human body, we must count the Neolithic a short period. When, however, we note the changes which have occurred in the configuration of the land, our minds are drawn in an opposite direction. Our leading geologists are convinced that, at the commencement of this period, England and the Channel Islands were joined to the Continent. A common estuary received the Rhine and Thames. English forest lands were continuous with those of France. And now, where those forests grew, are the wide Straits of Dover, the North Sea, the English Channel, and silted-up estuaries. When we come to estimate the period of time in which those changes could have been effected, we are met at once with our ignorance of the causes which underlie earth-movements. Mr Clement Reid has given years of study to the matter, and, in his opinion, such changes might have been effected in a short period of time—fifteen hundred years. Those, however, who base their speculations regarding what has happened in the past on what is happening in the present,

will allow a much longer period ; but all must admit that our estimates are, at present, little better than guesses. To account reasonably for all the facts we have at present at our disposal, we must, I think, allow a period of at least six thousand years for the Neolithic period in Britain.

There is a considerable body of evidence in favour of explaining the elevation and depression of the land in relation with the periods of glaciation. The elevation of the southern part of England is believed to have occurred when the ice-sheet of the last glaciation was retreating northwards. When subsidence was taking place in England, elevation was evidently at work in Scotland, for, as we have just seen, the Neolithic beaches of England are submerged, while those in Scotland are situated 25 feet, 50 feet, and more, above the present shore-line. A line drawn across the north of Ulster to Flamborough head on the Yorkshire coast corresponds in a broad way with the points where the submerged shore-lines of South Britain pass into the corresponding raised beaches of North Britain. In one of these raised beaches, on the south shore of the Firth of Forth, Dr Edward Ewart discovered Neolithic flints in abundance, and certain burials apparently of the same period. The skulls of these ancient Scots are also of the river-bed type—very similar in size and form to the Coldrum skulls. Farther north, in the Scandinavian Peninsula, elevation is now taking place at a rapid rate. Beyond the northern limits of Scandinavia lies the edge of the great perpetual ice-sheet.

It is believed [1] that the accumulation of a sheet of ice, several thousand feet in thickness, will depress that part of the earth's crust on which it rests. On the other hand, the part of the crust which lies immediately to the south of the ice-sheet will well upwards, it is believed, in the form of a wave, giving rise to such an elevation as is occurring in Scandinavia now. Still farther south, beyond the wave of elevation, there is a secondary trough or

[1] See article by Dr John W. Evans, *Nature*, 1911, vol. lxxxvii. p. 438. See also *Evolution of Climate*, by C. E. P. Brooks, 1922.

depression. At the commencement of the Neolithic period, if we entertain the explanation just given, the ice-sheet was disappearing from North Britain, and England was elevated on the wave which follows the retreating edge of the ice. During the Neolithic period, as the ice-margin retreated farther to the north, England was overtaken in the succeeding wave of depression—which apparently still continues. Such a hypothesis, purely speculative in nature, helps us to explain some of the phenomena with which we have to deal in future chapters. At least, it fixes in our minds the fact that the Neolithic age lies wholly within the milder period which followed the last long spell of glaciation.

Later we shall see that there is reason to believe that the same forces which act on our open seas and gather their waters into tides may also act on the solid globe itself, giving rise to rhythmical changes in the shape of the crust of the earth, causing terrestrial tides which ebb and flow from the poles (see p. 313). How far changes in climate are due to terrestrial tides and how far such tides may be accounted for by astronomers, are problems beyond the scope of this book.

CHAPTER IV

THE DISCOVERY OF PRE-NEOLITHIC MAN

In tracing the various kinds of men who lived in the Neolithic period, the open country, the river valleys, and the submerged land surfaces served us very well. When, however, we try to follow man beyond the bounds of the Neolithic period—beyond the time at which the Thames was depositing the deepest layers of ballast gravel in her ancient bed—we must seek sequestered nooks where the earth keeps a more orderly register of events than in the turmoil of flooded valleys. The ideal place we seek is a cave, particularly a limestone cave, for the drip from the roof, laden with lime salts, seals up with a covering of stalagmite any bones which chance to lie on the floor. The floor of such a cave is always having additions made to it. If men make their hearths on it, human débris accumulates. Chips and dust are always falling from the roof; the mud washed in by rain or flood is added to other accumulations. In course of time the floor may grow until it actually reaches the roof, thus obliterating the cave. If no living thing has visited the cave as it became filled up, then the strata of the floor are "sterile"; but if men have used the cave as a habitation or as a passing shelter, or if they chance to die or are buried there, then the earth-buried stratum of that time becomes a page of history. It has taken us nearly a century to understand that caves may contain historical documents of the most precious kind. By a study of cave records, we have come by a knowledge of the races which preceded the men of the Neolithic period—the races of the Palæolithic period.

We cannot begin a brief survey of how the very ancient world of Palæolithic man has been revealed to us more profitably than by taking our stand on the south coast of Wales, where we studied Neolithic man of the submerged-forest period. To the west of Aberavon and Swansea, the peninsula of Gower juts southwards, exposing its limestone cliffs, 100 feet high, on the shore of the Bristol Channel. The Paviland cave opens on the seaward face of the cliffs, 30 feet above the tide, but not beyond the reach of the waves in time of storm. In the latter part of the eighteenth century news of the discovery of extinct forms of animals—elephant, rhinoceros, bear, lion, and hyena—in the strata of caves in South Germany had spread abroad, and the antiquarians of South Wales were led to seek for and to find similar remains in the floor of the Paviland cave. This discovery brought Dean Buckland, then reader of Geology in the University of Oxford, hot-foot to South Wales in 1822. The Dean found abundance of the bones of these extinct animals in the strata of the floor; he also discovered the skeleton [1] of a tall man, coloured red with ochre, buried side by side with the bones of extinct animals. Curiously shaped flint implements, with ornaments and implements worked in bone and in ivory, lay in the same stratum. The Dean was able to explain the occurrence of a human skeleton side by side with the bones of extinct animals in a manner satisfactory both to himself and the men of his time. The animals were pre-diluvian; they had been swept within the Paviland cave by the great Flood through which the ark rode in safety. The human remains were post-diluvian; they had been buried there by people who had settled in Britain after the universal Deluge. It was then an article of faith that man did not exist in Western Europe before the Flood.

About the same time a Roman Catholic priest, the Rev. J. MacEnery, stationed near Torquay, became interested in caves. In 1825, in one of the wooded dales

[1] See Professor Sollas's Huxley Lecture, *Journ. Roy. Anthrop. Instit.*, 1913, vol. xliii. p. 1.

lying behind the picturesque town of Torquay, on the south coast of Devonshire, Mr MacEnery began to explore that great rambling subterranean series of chambers known as Kent's Cavern. In the dense layer of stalagmite covering the floor of the cave, he found implements in stone and in bone, shaped by the hand of man, mingled with the bones of the same extinct animals as Dean Buckland had found at Paviland. The priest had the courage to draw a just conclusion from these observations in Kent's Cavern, and to face the opposition of the Dean and of the opinion of his time. Mr MacEnery was convinced that man had lived in England as a contemporary of the mammoth, the rhinoceros, the cave-bear, and all those animals which we now know were native to Europe before our present climatic conditions dawned with the advent of Neolithic man. Mr MacEnery did not dare to even publish his records; they were discovered and published by the Torquay Natural History Society many years after his death.[1] It was thus a priest who first broke into the world of Palæolithic man—at least in England.

How slowly a belief in man's antiquity made headway will be realised if we follow Sir Charles Lyell in his journey abroad in 1833. He, the great geologist, was preparing a third edition of his *Principles*, and, as was his habit, visited every site in Europe where any discovery of note had been made. In 1833 his way lay through Belgium, and he stopped at Liège to see one of the Professors at the University—Dr Schmerling. The banks of the Meuse, before this river reaches Liège, are flanked by steep limestone cliffs, often 200 feet in height. On their vertical face open many rambling caves. Dr Schmerling had been caught in the vortex of cave exploration, and was able to place before the English geologist in 1833 the results gained by four years of severe toil in over forty caves. The collection represented those extinct forms of animals which Dean Buckland discovered

[1] See a Memoir of William Pengelly, by Hester Pengelly (Mrs Forbes Julian), London, 1897.

in the Welsh cave, but Dr Schmerling had found them in greater abundance and in greater variety.. The same evidences of man's presence were found mingled with the fossil remains of animals—worked flint implements, weapons and ornaments in ivory and in bone. In one of the caves—that of Engis—Dr Schmerling found a human skull, besides other fragments in the same cemented stratum of stalagmite as contained the fossil bones. "The cranium," says Dr Schmerling,[1] "was met with at a depth of a metre and a half (nearly 5 feet), hidden under an osseous breccia, composed of the remains of small animals, and containing one rhinoceros tusk. . . . The earth which contained this human skull exhibited no trace of disturbance; teeth of rhinoceros, horse, hyena, bear, surrounded it on all sides." Dr Schmerling had thus advanced our knowledge of man's antiquity a point beyond that reached by the Rev. Mr MacEnery at Kent's Cavern. Not only had he found proof of man's existence with animals now extinct—animals which had disappeared from the face of Europe before the Neolithic age dawned—but he had actually discovered Palæolithic man himself. Sir Charles Lyell was a true scientist, with an open and just mind, but he turned away from Dr Schmerling's discovery—still sceptical. Thirty years after the date just mentioned (1833), Sir Charles published a work which convinced thinking minds that man's antiquity was infinitely greater than usually believed. It took the scientific world thirty years to assimilate Schmerling's discovery. The discovery of the remains of a human being as the contemporary of extinct animals was more than even the open, well-balanced mind of Sir Charles Lyell could admit in 1833. Schmerling's work, like that of other pioneers, had to wait for a new generation.

We shall examine presently the facts which afterwards convinced Sir Charles Lyell that Dr Schmerling had made a great discovery. In the meantime, let us see what kind

[1] *Recherches sur les ossemens fossiles découverts dans les cavernes de la province de Liège*, 1833.

of man he discovered—the man who lived when the mammoth and woolly rhinoceros had a home in Belgium. When an exact drawing of the Engis skull is placed within the standard frame—the one we have employed in the case of Neolithic skulls—we see that in shape and size it is merely a variant of the river-bed type. It is longer, higher, and rather narrower; it is very similar to the skull of the Neolithic man found at Sennen, in Cornwall. The skull is that of a man of middle age. The maximum length is 198 mm.; the width, 140 mm., is 70·7 per cent. of the length. The height of the vault above the ear-holes is 121 mm.; the calculated brain capacity 1500 c.c.—

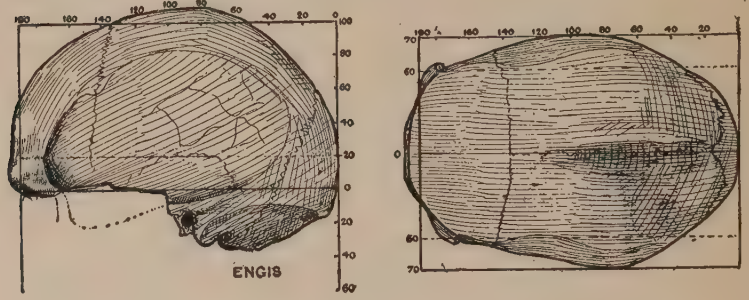

FIG. 25.—Views of the Engis skull from the side and from above.

a little above the modern average. There is not a single feature that marks this skull off from men of the Neolithic or of modern times. No doubt, if the face and the jaws had been found we should recognise certain points of difference in them, but, unfortunately, these parts were not recovered. If we believe that the human frame must change during the lapse of a long period, then we shall be inclined to regard the evidence of the Engis cave with scepticism. If, however, we regard Dr Schmerling as a competent and truthful observer—and I think the time has come when belated justice must be done to him—then we must conclude that a human type can be reproduced for many generations and over a very long period of time, and still remain almost unchanged. The man who lived in Belgium with the

extinct animals of the Pleistocene period was reproduced in the Neolithic period, and still abounds in modern times. When Sir William Boyd Dawkins wrote his classical work on *Cave Hunting*,[1] he was not convinced on the evidence produced by Schmerling that the skull was contemporaneous with the fossil animals. Once again my friend, Dr Rutot, has, in company with Professor Fraipont, examined the Engis skull, and he, too, is inclined to place it in the list of doubtful specimens.[2] It is true, as we shall see presently, that people of the Neolithic period did use caves as sepulchres, but there is no instance of Neolithic man having dug a hole in the hard breccia of a cave floor and buried his dead at a depth of 5 feet: Schmerling has placed it on record that the breccia was intact, and therefore we must admit that the river-bed type of skull was already evolved in the Palæolithic period.

The discovery which cleared away all doubts as to the great antiquity of man—which carried home the conviction that he was contemporary with extinct animals—takes us to the year 1860. The discoverer was Edouard Lartet, then aged fifty-nine. He had, in his early years, forsaken law for geology, and latterly had been caught in the passion for cave exploration. The year 1860 found him visiting the caves of Southern France, particularly those situated in the Departments lying among the northern spurs of the Pyrenees. We have to deal with two of these particular Departments of France—Haute Garonne and Ariège, drained by rapid-running tributaries of the Garonne. Lartet's excursion took him to the village of Aurignac, in Haute Garonne (see fig. 60, p. 166). Near by the town is a little hill; on the side of the hill a cave had been discovered buried beneath a mass of débris which had fallen from the face of a cliff. Apparently in ancient times the cave had opened on the face of the cliff. In fig. 26 I reproduce the drawing with which Lartet illustrated his discovery. When the

[1] *Cave Hunting*, Macmillan & Co., 1874.

[2] "Coup d'œil synthétique sur l'époque des cavernes," *Bull. de la Soc. Belge de Géologie*, 1909, vol. xxiii. p. 227.

débris which hid the cave was removed, the opening was found to be closed by a great vertical slab of stone. Before Lartet's arrival, the human skeletons seen piled up within the cave (fig. 26) had been given a Christian burial by order of the Mayor. We now know, although Lartet was not then aware of the fact, that the pile of skeletons—representing at least seventeen individuals of various ages—were in reality the remains of Neolithic people. It was the Neolithic men who set up the slab at the entrance and used the cave as a sepulchre, a

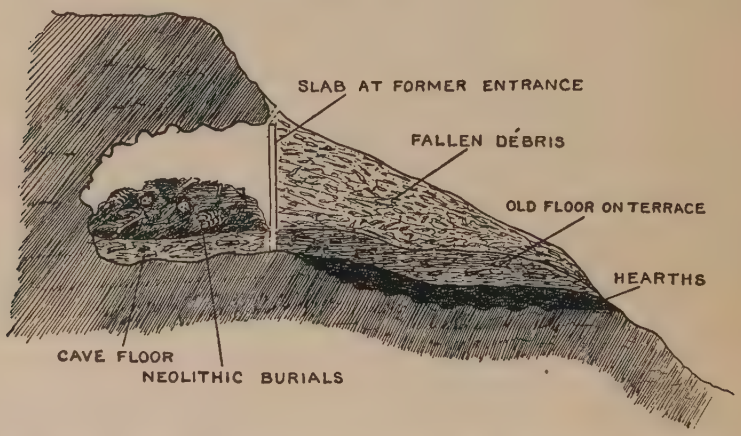

FIG. 26.—A section of the cave explored by Lartet, near Aurignac, in 1860.

custom of the period. But when Lartet came to explore the floor of the cave—2 to 3 feet in thickness—he found it to abound in evidences of human habitation, and to contain the remains of extinct animals, which were charred, cut, and artificially broken, showing that man not only lived at the same time as extinct animals, but actually used them as sources of his food supply. He found remains of the cave-bear, the cave-lion, the cave-hyena, the mammoth, the woolly rhinoceros, the wild pig, the Irish deer, the bison ; and also remains of animals which live in our time. He found, further, as will be seen from his drawing, that the strata of the floor extended out to cover the little terrace in front of the cave. Under

the floor of the terrace he found abundance of charcoal and remains of hearths. Embedded in the débris of the floor he found implements and ornaments of that form of human culture which is now known as Aurignacian—the same culture as was exposed at Paviland and at Engis. The flint implements of all three caves were worked in the same style—in all there were the same carvings in ivory, the same ornaments, necklaces of shells and perforated teeth, the same kind of barbed implements in bone, antlers of reindeer, and in ivory. When we consider that the culture of the people on the South Welsh coast was the same as that at the northern foot of the Pyrenees, we begin to realise that even in the Pleistocene period—when animals now extinct abounded in Europe—interchange and intercommunication had already made Europeans sharers in a common culture. Lartet also found amongst the undisturbed débris in the floor of the cave, fragments of human bones—not enough to tell us what kind of men these ancient Aurignacians were, but sufficient to indicate their bodily presence. It was the discovery at Aurignac which convinced Sir Charles Lyell that man went beyond the Neolithic horizon, and with his conversion, the new conception of man's antiquity made rapid progress.

Eight years later, in 1868, M. Lartet's son, Louis, discovered the actual men of the Aurignacian culture. The scene of the discovery is not in the region of the Garonne, but in the watershed of a companion river, the Dordogne, which, rising in southern central France, joins the Garonne at Bordeaux (see fig. 60, p. 166). The Vézère is a northern tributary of the Dordogne. The caves and rock-shelters in the limestone cliffs which border the Vézère have yielded some of the most important and most complete records of ancient man. In 1868, when a railway was being made along the lower part of the valley of the Vézère to unite the town of Périgueux with the main line along the Dordogne valley, an old rock-shelter was opened at Cromagnon, a little above the picturesque cliff-set village of Les Eyzies. The strata on the floor of

the rock-shelter, a recess at the foot of the cliff, were marked by hearths and the culture of the Aurignacian period. In the upper strata were found the remains of five skeletons, four being of adults. They were tall people; the men were about 5 feet 11 inches in height (1·8 m.)—tall, lanky fellows, more like, so far as bodily physique is concerned, the tall Sikhs of the Punjaub than any race now living. The proportion of their limbs was somewhat peculiar; their tibiæ or leg bones were relatively long, their humeri or upper arm bones short. Individuals with similar limb proportions still occur amongst negroid races, but no modern European race can show the negroid limb proportions of the Cromagnon race—men of the Aurignacian period. The skeleton which Dean Buckland had found in the Paviland cave, regarded by him as that of a woman buried in Neolithic times, but which we now know, as proved by Professor Sollas,[1] to be of Aurignacian age, was also a tall, slender man—about 5 feet 10 inches in stature. The skull of the Paviland man is not known, but we do know the form of head which characterised the Cromagnon men. Their skulls cannot be classed in the river-bed groups; they are too large and too much flattened on the vault to be assigned to that type. They differ from the Aurignacian man of Engis, who, we have seen, had a skull of the river-bed type. At Cromagnon, then, we meet with another race of men. They had massive skulls, large in all dimensions, as will be seen from fig. 27, where the skull of the "old man of Cromagnon" is fitted within the standard frame used for Neolithic and for modern skulls. It is much too large for the conventional modern frame. The maximum length is 203 mm., half an inch beyond the modern or Neolithic mean; the width, 150 mm., 10 mm. beyond; the height of the vault, 125 mm., also 10 mm. above the modern mean for British men. It will be observed, however, that although the actual dimensions are greater, in the relative proportions of the diameters the Cromagnon skulls are not unlike those of

[1] See reference, p. 67.

the river-bed type. The width is very nearly 74 per cent. of the length, just as in skulls of the river-bed type. The brain capacity is much greater—roughly 1660 c.c., being 180 c.c. above the modern average. We have to remember that a certain amount—a small amount—of that is due simply to a big body; a big body needs a bigger brain for its animal administration. We have come across, in those large heads, a puzzling and unexpected fact; we are naturally astonished to find that men who have preceded us so long ago—men of a

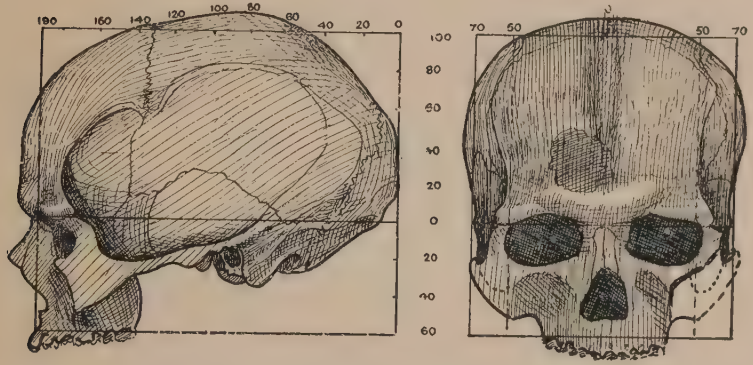

FIG. 27.—Skull of Cromagnon man viewed from the side and from the front.

former geological epoch—should so far outstrip their successors of to-day who regard themselves as "the survival of the fittest," and believe the fittest to be the race with the biggest brains. We cannot quarrel with the facts, but how are we to explain them? The conclusion to be drawn is, not that brain mass, on the average, is to be rejected as an index of brain power, but that there are other virtues or characters which go to ensure success of a human race in the struggle of life—other than brain power. A philosopher may be miserable and die childless, when a brainless savage or an industrious labouring man of mediocre ability may be happy and leave a large family.

Since 1868, as we shall see later, many further dis-

coveries of the Cromagnon race have been made. Meantime, we simply note that, although in dimensions—in stature and in size of body—these Cromagnon people far outstrip the river-bed type of the Neolithic period, and probably also of the Palæolithic period, the two types are not radically different. To me, they seem to represent the "longs" and the "shorts" derived from a common stock.

At all those sites—at Paviland, Kent's Cavern, Engis, Aurignac, and Cromagnon—the discoverers of man's early history stumbled across a stage in human evolution which was manifestly older than the Neolithic phase; but how much more ancient they could not then tell. That secret they soon set out to discover. When the skeletons were found at Cromagnon (1868), it was becoming apparent to the explorers of the French caves that the Palæolithic period, into which they had forced a way, had seen the dawn and the close of many phases of human culture, and that, in the floors of the caves, there was clear evidence that these phases passed in an orderly succession. It became clear to them that, as in historical times, a new form of culture arose gradually, and as gradually replaced the older modes of life. Hence we find, from this time forwards, that the investigators of France bent all their efforts to distinguish the various cultures represented in the caves, and to establish the order of their succession. As early as 1869, M. Gabriel de Mortillet [1] elaborated an orderly classification of the cave cultures; but the exact position represented by the culture of the caves at Aurignac and at Cromagnon was not finally settled until 1905, when the Abbé Breuil finally proved that at least two periods of culture, the Solutrean and the Magdalenian, intervene between the end of the Aurignacian and the dawn of the Neolithic period.[2] During those intervening periods, the climate

[1] See *Musée préhistorique*, by G. and A. de Mortillet, 1903.

[2] See Bibliography of the Abbé Breuil's researches from 1899–1910, published at Fribourg, Switzerland, 1910. His more recent publications will be found in full or in abstract in that excellent periodical *L'Anthropologie*.

of Europe continued cold; the mammoth, the woolly rhinoceros, the cave-bear, the cave-lion, the cave-hyena disappeared; the reindeer became the characteristic animal in Europe in the closing phases of the Palæolithic period.

Aurignac, we have seen, is situated five miles to the west of the upper waters of the Garonne; twenty miles to the east of the same stretch of the river lies the village of Mas d'Azil (fig. 60). Past this village runs a tributary of the Garonne—the Arize. Issuing from the hilly ground at the foot of the Pyrenees this stream, near Mas d'Azil, pierces a spur of limestone rock and runs through a great subterranean gallery or tunnel, some 500 yards in length. When the public road, which follows the tunnel made by the Arize, was being repaired, the strata on the banks of this subterranean stream revealed the hearths and implements of ancient man. In 1887, M. Edouard Piette, a magistrate, who spent his leisure hours and his income most liberally in advancing our knowledge of ancient man, began a systematic exploration of the strata in the recesses of the cavern of Mas d'Azil, and discovered cultures which mark the transition from Palæolithic to Neolithic times. In 1895 he published [1] a section (fig. 28) showing the various strata which are piled one above the other on the western bank of the Arize, as it issues from the tunnel. The uppermost, and therefore latest stratum, is situated 13·60 m. (44 feet) above the level of the stream. The two upper deposits, composed of black clay with intermingled débris, amounting to a depth of 5 feet, were formed between the closing phase of the Neolithic period and the time of the Roman occupation, for they contained abundant traces of the civilisation which came and went during that interval of time—some two thousand years. The third stratum, counting from the surface downwards, is little more than a foot and a half in thickness, and, composed of a laminated assortment of differently coloured clays, brings us well within the Neolithic period, for the

[1] "Études d'ethnographie préhistorique," *L'Anthropologie*, 1895, vol. vi. p. 276.

objects of culture are such as are found in the kitchen-middens. The fourth stratum reveals the transition culture, the one now distinguished as Azilian. The fourth or Azilian stratum is only half a metre thick (19·6 inches), intensely red in colour, due to the abundance of oxide of iron which it contains. Beneath the Axilian stratum lie five others, forming collectively a deposit over 17 feet in thickness, all of them marked by the culture of the last great Palæolithic period—the Magdalenian. The deepest Magdalenian stratum, made of gravel, lies on the bed-rock, 23 feet above the present

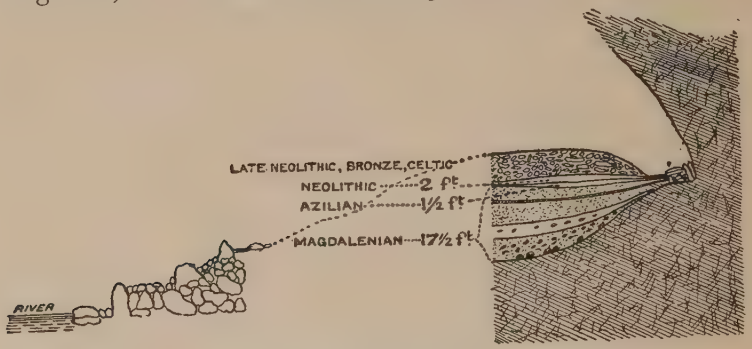

Fig. 28.—M. Piette's section across the strata at Mas d'Azil.

bed of the Arize. The men of the Magdalenian period settled on the ancient gravel bed of the Arize. In the bottom stratum occur the remains of their hearths. The period during which these Palæolithic deposits were being formed was marked by two great intervals of flood or submergence, for the various strata, showing periods of human occupation, are separated by two thick deposits of yellow loam—the products of great and continuous floods. In all the Magdalenian strata, remains of the reindeer occur abundantly. In the Azilian stratum, which follows the Magdalenian strata in orderly sequence, the reindeer disappears; its place is taken by the stag, the remains of extinct mammals no longer occurring in the Azilian layer. The human culture, however, did not change much. The Azilians worked their flints in the

Magdalenian manner; they fashioned the same carved and barbed harpoons and arrow-heads from bone and from antlers. They were partial to the use of red ochre as a pigment. Rounded pebbles, marked with coloured hieroglyphics, formed a peculiar and enigmatical part of their civilisation. Perhaps they had taken the first steps in agriculture; at least M. Piette found in the Azilian stratum traces of wheat husks and stones of cherry and plum.

In this way M. Piette revealed at Mas d'Azil the long records of the closing phases of the Palæolithic period and the opening stages of the next or Neolithic period. In the Azilian stratum he found two sepulchres, but the human remains discovered by him are insufficient to give an accurate picture of the people. So far as our evidence goes, it supports the opinion that the Europeans of the Azilian civilisation were members of the Mediterranean race, and had heads of the river-bed type. Although numerous Azilian stations have been discovered in recent years, particularly in France, none has revealed the peoples of the period.

We have no reason to suppose that the transition from the Palæolithic to the Neolithic period was marked by the appearance of a new or higher type of man. Indeed, in artistic ability, there must have been a decline, for the later Palæolithic periods have furnished us with the most abundant and surprising evidence of a high artistic ability. The people who lived in the south-west part of France and the north-west part of Spain in all the phases of the Aurignacian period covered the walls of their caves with most realistic drawings of the animals which were hunted and captured by them. The artists often worked within the darkest recesses, where they had to rely on such light as their primitive lamps could give. They engraved and carved bone and ivory with a rare skill. The animals they modelled in clay have had implanted on them the poise and spirit of life. They were hunters and had leisure as well as artistic impulses.

CHAPTER V

CONTINENTAL TYPES OF MAN DURING THE LATER PALÆOLITHIC PERIODS

For visiting the abodes of ancient man in the south-west of France there are few towns can rival the attractions and conveniences of Périgueux. Its sunlit streets and wide places are spread over the flat green meadows of the Isle, a tributary of the Dordogne ; at every turn the visitor is met with traces of Moorish architecture. A railway journey of twenty-five miles towards the south-east carries the traveller to Cromagnon, Les Eyzies and the lower valley of the Vézère with its limestone cliffs and caves. Our visit to Périgueux on this occasion, however, is not to see the famed haunts of ancient man on the Vézère ; our journey lies northwards along the road which runs from Périgueux to Brantôme, and its object is to ascertain the circumstances which led to the discovery of one of the hunters who lived in this part of France during Magdalenian times, and to see what kind of man he was.

Along this road, a little over four miles from Périgueux, we pass the village of Chancelade, with its old and ruined abbey church ; beyond the village the road winds before us, flanked on the right by an irregular wall of limestone cliffs. Between the foot of the cliffs and the margin of the road is a bank of rubble—a talus—formed by blocks and fragments detached from the face of the cliffs by the frosts, winds, and rains of past ages. It was beneath the talus by the side of this road that the Chancelade man was discovered (see fig. 29A).

In 1887 two well-known archæologists of Périgueux, MM. Hardy and Feaux,[1] as they walked towards Chancelade, found contractors laying a tramway line, and were surprised to observe, scattered amongst the material which had been recently laid down to mend the road, most beautiful examples of the handicraft of Magdalenian man—both in flint and in bone. Having

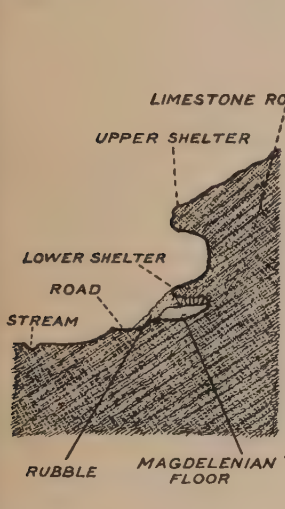

FIG. 29A.—Section of the limestone cliff and talus near Chancelade. The site of the Magdalenian deposits and floors is indicated. (After M. Hardy.)

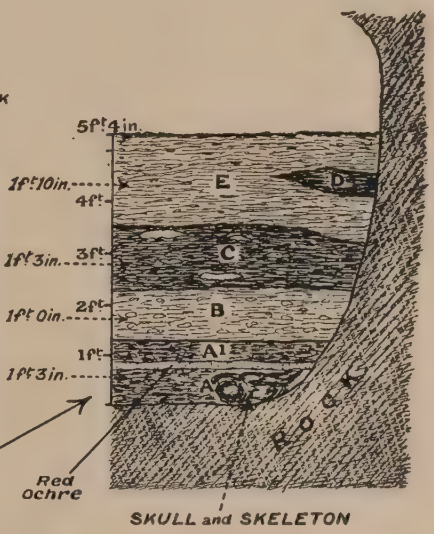

FIG. 29B.—Section of the strata under the rock-shelter of Chancelade, with the position of the skeleton indicated. (After M. Hardy.)

filled their wallets, they made inquiries as to where this precious road-dressing had come from and were directed to the talus which lay under the cliff. Trenching operations undertaken by MM. Hardy and Feaux revealed the arrangement of deposits shown in figs. 29A, 29B. The talus had formed in front of, and hidden completely, a recess or shelter in the cliff which had long been the

[1] Michel Hardy, "La Station Quaternaire de Raymonden" (a parish to the north of Chancelade), *Bull. Soc. Histor. et Archéol. du Perigord*, 1891, t. 18, pp. 65, 121, 195.

home of men during Magdalenian times. On the floor of the shelter were found deposits which were 5 feet 4 inches in depth; five strata could be recognised; two of them (E and B) were sterile, showing long intervals in which the cave had been forsaken; three strata, A, C, D, represented "occupation levels," and were packed with flints and bones worked in the typical Magdalenian style as well as with the refuse of meals and the embers of hearths left by the cave-dwellers. The remains found in the strata were those of animals which are native to cold and semi-Arctic countries.

In 1887 MM. Hardy and Feaux found only some bones of a child and the frontal bone of an adult skull, but on 1st October 1888 they came across the skeleton of a man who had been buried under the deepest and oldest of the deposits, and rested on the floor of the rock-shelter (fig. 29B). The skeleton lay on its left side, in the crouched position—arms folded on the breast, lower limbs doubled against the body, its head to the south. The upper part of the material in which the skeleton lay had been powdered over with red ochre—a substance to which Palæolithic man seems to have attached a peculiar significance; at least its application seems to have formed part of his burial service. In this case the bones of the skeleton were ochre-stained. The skull, in a somewhat crushed state, and the rest of the skeleton, were examined and described by Professor L. Testut[1] of the University of Lyons.

Chancelade man has to shoulder, almost alone, the heavy responsibility of representing to us the men of Europe during that closing phase of the Ice age which is marked by the Magdalenian culture. We must therefore look rather closely at his features, more especially because an extravagant theory has been built up on them. He was a short, somewhat squat man; his thigh bone has, at its greatest length, a measurement of 408 mm.; his stature may be estimated to have been about 1·570 m. (a little under 5 feet 2 inches). The imperfect state of his limb

[1] *Bull. Soc. d'Anthropologie de Lyon*, 1889, t. viii. p. 131.

bones makes any exact statement relating to the relative length of leg to thigh and of forearm to upper arm impossible. Professor Testut found the heel relatively longer than in modern man, and gives a drawing of the bones of the foot, in which the great toe is represented as widely separated from the other toes, as if this digit had still retained some of the mobility possessed by the hallux of anthropoid apes. The shape of the joints and bones of the great toe of the Chancelade skeleton in no

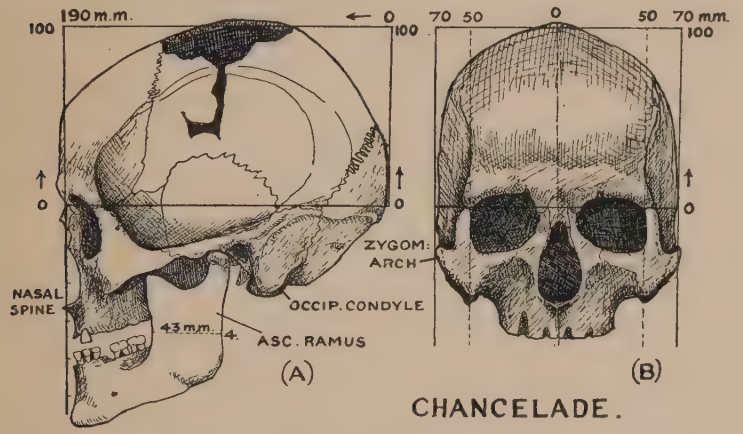

FIG. 30.—Drawings of the Chancelade skull as seen in profile (A), and in full face (B). (After Testut.)

way departs from that which is frequently to be seen in modern races of mankind which live under primitive conditions. As regards his feet, Chancelade man was altogether human and European.

When we turn to his skull, we find he was big-headed ; the maximum length of the skull is 193 mm., its greatest width 139 mm. ; the width represents 72 per cent. of the length ; he was narrow-headed, and the roof of the skull was particularly high-pitched ; it rises 124 mm. above the ear passages. If we apply to these measurements the Lee-Pearson formula [1] for estimating size of brain we get a result of 1530 c.c.—about 50 c.c. above the average for

[1] See p. 596.

modern Englishmen. When the anthropologist examines the skull, for it is still preserved in Périgueux, he is struck by its shape as seen in profile (fig. 30). The forehead, which is wide (101 mm.) and furnished with supra-orbital ridges of moderate development, rises steeply and merges as it passes backwards into the high-pitched roof. The hinder part of the roof descends steeply to the occiput, reproducing an outline with which one is familiar in round or brachycephalic skulls, in which the hinder end or occiput is flattened. As is usual in such skulls, the part which contains the cerebellum bulges downwards into the root of the neck. From the side the Chancelade skull suggests that it belongs to the brachycephalic or rounded type, and we are surprised therefore when we look at it from above or from the front (fig. 30B) to see that it is narrow and long. Some degree of this narrowness may be due to compression of the skull by the overlying strata of earth ; we may note, at least, that there is more than a suspicion of brachycephalism about the Chancelade man. The total height of the skull, from basion to bregma, is 150 mm. ; he had a very narrow and a very high head. The sides of the head approximate somewhat rapidly as they ascend from the level of the ear passages to the roof. One may still observe in various countries of Europe men whose skulls are fashioned both as regards size and shape in what may be named the Chancelade manner.

To what racial type did the Chancelade man belong ? All of us are anthropologists at times ; we instantly recognise the negro, the Chinaman, and other well-differentiated types of mankind who may pass us on the road or street. The colour of their skin, the texture and colour of their hair, but, above all, the features of their face, help us to assign them to their racial type. The untrained observer seldom takes the shape of head into consideration. When we have to base our opinion, as in the present case, on fossilised bones obtained from an ancient grave, our task is more difficult. Often we have only that part of the skull which contains the brain, and

even when we make the most of it, our diagnosis of race must remain uncertain; but in the case of the Chancelade man we have the face as well. Of the various features which are modified by race, perhaps the nose is the most helpful. Here we have to deal with a man who had a long straight nose; from the nasion at its root to the spine projecting from the sill of its bony aperture (fig. 30) the nose measures 61 mm.; its width in relation to the length is moderate, 26 mm.; the width of the nose was less than 43 per cent. of its length. Unfortunately a part of the bridge was broken away, so we cannot tell its degree of prominence, but, seeing that the face as a whole was distinctly flat, we may conclude that its bridge was not greatly raised. The spine projecting from the sill at the nasal opening reaches freely forwards, jib-like, and from the side of the spine run off sharp margins of bone to become continuous with the two lateral margins of the aperture. This configuration of the nasal spine and nasal sill is not primitive or simian; it is the very opposite. In apes, as in all primitive races of mankind, the nasal spine is but a stout, low, ridge-like elevation with, on each side of it, a broad gutter leading from the floor of the nose to the front of the jaw above the incisor teeth. We meet here with a feature which the Chancelade man shares with most modern Europeans. Some of us still retain traces of our simian heritage. The face of the Chancelade man appears to be flat because of the peculiar configuration of his cheek-bones and zygomatic arches (fig. 30). These bony struts give attachment to a pair of the principal chewing muscles; the stronger these muscles are the stouter and more prominent are the bony arches. The width of the face, measured between the most projecting parts of the zygomatic arches, is 140 mm., some 6 mm. more than is usual in modern Englishmen, but the essential peculiarity lies in the outward bend these arches make as they turn inwards on the face at the cheeks. This is a feature which is particularly developed in the skulls of Eskimo, and it is chiefly upon the possession of this feature that the Chancelade man

has had the misfortune to be assigned to a Mongoloid race. How well his muscles of mastication were developed may be seen from the breadth of the ascending ramus of his lower jaw, which measured 43 mm. (fig. 30A)—at least 7 mm. above the modern average. He had not the projecting jowls of the Eskimo; the distance between the angles of his lower jaw was only 93 mm., whereas in Eskimo and in other races to be mentioned later, this—the bigonial diameter—will often amount to 110 mm. or even 120 mm.

Then there is the great development of the chin—a feature of highly-evolved man. The chin is massive and deep; from its lower margin to the alveolar border where the front teeth were implanted measures 41 mm. He was long-faced; I estimate that when in his prime, and before all his upper teeth, save the remnants of three front ones, had been lost from wear and disease, his face had measured about 125 mm., so that, although the zygomatic arches are wide in comparison with the width of the skull, yet they are in keeping with the facial length. The eye sockets were of moderate dimensions—not deep from upper to lower margin as in Eskimo skulls. In the Chancelade man we are dealing with a member of a racial stock of a true European kind.

He is estimated to have been between fifty and sixty years of age; most of his upper teeth, as already mentioned, had been lost from disease; most of the lower teeth remained intact. The three lower molar teeth have a combined length of 32·5 mm.—not a great amount, but they had this peculiarity—the last molar was the largest and the first molar the smallest of the series, certainly a primitive proportion, for in most modern Europeans the order is reversed, the last molar being the most reduced in size and development of parts. Professor Testut estimated that the chewing palate—the area included within the outer margin of the upper teeth—was 51 mm. from front to back, quite a moderate measurement, and 60 mm. in width at the points where the second upper molars had been implanted. From which

we see that as regards size and shape the palate of Chancelade man falls easily within the modern range of measurements.

How many millennia have come and gone since the Chancelade man lived in his rock-shelter and hunted game in the neighbouring valleys? There is abundant evidence to prove that in France, England, and South Germany the Magdalenian culture was at its height during the last advance and retreat of the ice-sheet which marked the final phase of the Ice age. Between the Magdalenian and the Neolithic periods in Western Europe intervenes that period of transitional culture mentioned in my last chapter—the Azilian. We have seen that there are grounds for believing that the earliest forms of Neolithic culture appeared in Europe about 8000 B.C. If we allow two thousand years for the duration of the transitional or Azilian culture, we must place the end of the Magdalenian age about 10,000 B.C. If we take into account the remarkable changes in the climate and in the fauna which occurred during Magdalenian times, the modifications which the culture of this period underwent and the deep deposits which were then formed in the floors of caves, we are probably making an underestimate when we allow three thousand years for the duration of this period. If our estimate is reliable, than the Chancelade man should belong to about the twelfth millennium B.C.

In our search for the kind of man who lived on the Continent during the later periods of Palæolithic culture, we have to move to another pleasant town of France, Maçon, on the right bank of the Saône, forty-three miles to the north of Lyons and fully 200 miles from Périgueux as the crow flies. It was north of this town that Cæsar found a large part of the population of Switzerland seeking to cross the river and trek across the plain to the west; it is in this direction our footsteps are now bent. A little over four miles to the west of Maçon the meadowland rises into low hills and spurs. On the shoulder of one of these spurs is situated the village of Solutré; above the village rises the "rock of Solutré," a bluff of limestone,

showing its cliff-like face to the south and to the east. In the rough land which slopes upwards from the village to the foot of the rock, strewn with blocks of limestone detached in ancient times from the face of the rock, lay hidden some of the most remarkable of our records concerning the history of Palæolithic man.

Hitherto, so far as we have followed man into the Palæolithic period, we have sought his traces in caves. In 1866, two French antiquaries began a series of explorations at Solutré which revealed the habitation of Palæolithic man in the open country. Although MM. Ferry

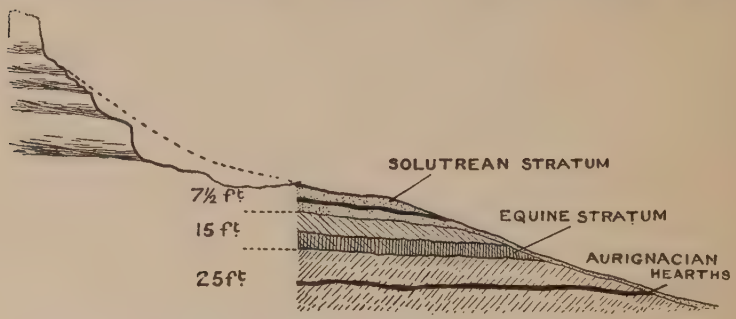

Fig. 31.—Diagram of the ancient hearth-strata exposed in the deposits at Solutré.

and Arcelin commenced their investigation in 1866, inspired by the writings of Sir Charles Lyell, such was the extent of the Palæolithic deposit at Solutré, covering as it does more than 2 acres of ground, that its exploration occupied one of them—M. Arcelin—until his death in 1904.[1] In a paper which he published in 1890,[2] he reproduced a section of the deposits at Solutré, which serves to convey the results of his toil at a glance (fig. 31). At the western end of the section, the rock of Solutré rises to a height of 300 feet. The land slopes eastwards from the base of the rock towards the Saône, and covers the deposit which reveals the hearths of ancient man. At certain points the exploring trench had to be sunk

[1] See Dechelette's *Manuel d'archéologie préhistorique*, 1912, vol. i. p. 133.
[2] *L'Anthropologie*, 1890, vol. i. p. 295.

to a depth of 34 feet to reach the original surface of the land. Wherever the trench was sunk in this ancient and extensive station, one remarkable stratum was always encountered, usually at a depth of about 10 feet below the present surface. This "equine" layer, varying in thickness from 15 to 20 inches, was made up of bones of horses, broken, cut, and charred, mixed up with the débris which accumulates on and around the hearths of ancient man. The implements of flint and bone, the ornaments, the works of art, the remains of extinct animals, found in the equine layer, are similar to those which occur at Aurignac. The equine layer represents a vast kitchen-midden of man during the Aurignacian period. It has been calculated that the colony at Solutré had consumed at least one hundred thousand horses in their time. Beneath the equine stratum occur one, occasionally two, older Aurignacian floors, marked by extensive hearths (fig. 31). In the deepest of these, implements which characterise a still older Palæolithic culture were gathered—implements of the Mousterian type. Above the equine layer there is a stratum containing ancient floors which yield abundant evidence of a more recent culture, the culture which succeeded the Aurignacian, and which has been named, because of its discovery here, "Solutrean." A form of finely worked flint implement — shaped like a laurel leaf— appears for the first time in Western Europe with this new culture. Certain animals of the Aurignacian period were dying out; reindeer were becoming more abundant. Art, we know from discoveries elsewhere, still maintained a high standard. In the Solutrean period Solutré itself ceased to be a site of habitation, for it shows no trace of the men of the succeeding Magdalenian period which we have been examining at Chancelade, and which we also noted at Mas d'Azil.

The land surface had reached its present level on the shoulder of the hill at Solutré when people of the Neolithic and subsequent ages buried their dead over strata containing the remains of two long Palæolithic periods.

During 1922, 1923, renewed explorations of the Palæolithic field of Solutré ended in discoveries of great importance. M. Fabien Arcelin, son of the pioneer, was joined by M. Ch. Depéret, Professor of Geology in the University of Lyons. These ten years past Professor Depéret has been setting in order our knowledge of the terraces or deposits found along the river valleys of Europe, settling their sequence and their age, and linking them with raised beaches which occur on the shores of the Mediterranean and North Sea. There were problems at Solutré which demanded further elucidation. During the excavations carried out last century, skulls of round-headed people had been found in the upper layer at Solutré; they were at first accepted as authentic representatives of Palæolithic man, but later were rejected as intrusions because they did not conform to a preconception which became prevalent—namely, that ancient Europeans were all of the long-headed type. To settle this and other problems, deep and wide trenches were dug across this classical Palæolithic field from east to west, during 1922, 1923, under the direction of MM. Depéret, Arcelin, and Mayet.[1] In the autumn of 1923, deep in the stratum which contains the ancient hearths of the Aurignacian period, and well under the stratum which is packed with bones of horses (fig. 31), also a deposit of the Aurignacian period, they exposed complete skeletons of three adults, two of men and one of a woman; all three adults were under thirty-five years of age and had complete sets of healthy teeth. Near the woman's skeleton were remains of the skeletons of two babies. These three adults had been buried in a line running from east to west; they lay on their backs, with limbs extended, heads to the west and feet to the east; about two paces separated the one grave from the other. The old land surface, from which the burials had been made, is now covered with the stratum containing the horse bones; over this stratum are the deposits of the Solutrean and

[1] *Comptes Rendus, Acad. des Sc.*, 1923, t. 177, p. 618. *L'Illustration*, 20th Oct. 1923, p. 389.

Neolithic ages. At each side of the head of all three skeletons stood a flat block of limestone ; the upper ends of these two blocks, when the burials were freshly made, had projected on the surface to mark the position of the dead and to serve as tombstones. It is remarkable, as the discoverers have observed, that certain tribes in Algeria should still adopt this ancient style of burial with double tombstones at the head.

At Solutré, then, we have an opportunity of ascertaining the kind of people who lived along the Saône valley in the full bloom of the Aurignacian culture. One man (No. 2) was tall—about 1·800 m. (5 feet 10·8 inches)—thus resembling the men of Cromagnon. The other (No. 1) had a stature of 1·750 m. (5 feet 9 inches). The woman was not tall : she stood about 1·550 m. (5 feet 1 inch). It is clear that the Cromagnon race was one in which the sexual difference in stature was extreme—the women falling short of the average stature of women, while the men exceeded the average for men. Their limb bones were robust but had none of the peculiarities which characterise the limb bones of the men of Cromagnon—no front-to-back flattening of the upper shaft of the thigh bones, no side-to-side flattening of the leg bones, no great bony pilaster behind the shaft of the femur ; the leg and forearm were not of great relative length.

We have seen that there is a suspicion of round-headedness in the skull of the Magdalenian man of Chancelade, this feature is no longer a suspicion in the man of Solutré ; these much older representatives of the Palæolithic people of France are frankly round-headed or brachycephalic. At Solutré we come across the first definite evidence of the existence of round-headedness in Europe, which now characterises so large a part of the population of this continent.

The skull of the tall man (No. 2) is shown in fig. 32, set within the standard frame of lines which serves to mark the average long skull. Its length is only 184 mm., its width 146 mm., the width is 79·3 per cent. of the length ; it is on the border line of brachycephalism as

regards its measurement, but so far as concerns its conformation it is wholly there. In the other man (No. 1) the relative head-breadth or cephalic index is 79·1 mm.; in the woman 77·7 mm. It is a curious circumstance that in a race which tends to length of head, the men should exceed the women in this quality; if the tendency should be towards shortness of head, the men still outdo the women; in both cases the woman's head-form is the more conservative, tending towards a mean proportion of breadth to length. As regards size of head and capacity

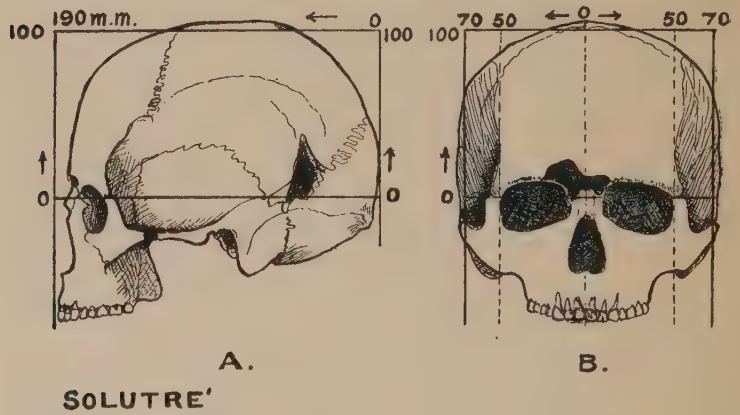

FIG. 32.—The skull of the tall man of Solutré seen in profile (A) and in full face (B). (After Mayet.)

of brain chamber, the tall man of Solutré, on our English way of reckoning, had a brain-volume of 1550 c.c.—some 70 c.c. above the average capacity for men; the shorter man, estimated on the same basis, had 1472 c.c.—his capacity almost corresponding to our modern mean.

As regards form of face, these men of Solutré are remarkably like the Chancelade type. There is the same widely spread zygomatic arches—the bizygomatic diameter of the face is 143 mm. in the tall man—the same width of face as in the short man of Chancelade. There is the same long nose and upper face. In the tall man the distance from nasion to alveolar margin is 73 mm. —almost the same as in the man of Chancelade. There

was the same long nose of moderate width; there was the same well-developed chin with the same great depth of lower jaw at the symphysis or chin. Their orbits and forehead were also modelled in a similar way to those of the Chancelade type. There cannot be a doubt that the people that lived at Solutré in the Aurignacian period were of the same racial stock as the people who long afterwards, in the Magdalenian period, lived in the neighbourhood of Chancelade.

It will be noticed that the cave strata at Mas d'Azil take up the story of ancient man where the deposits at Solutré leave off. In the 60 feet of strata, represented at the combined sites, are found the cultures of four consecutive periods—Aurignacian, Solutrean, Magdalenian, and Azilian—with superficial traces of the Neolithic period. It is plain that we have made a long journey into the past to reach the Aurignacian period; how long we can but dimly perceive at present. The formation of a deposit 30 feet deep at Solutré must have occupied a long space of time. The process of its formation is revealed by M. Arcelin's section. The great blocks of stone and the rocky débris which lie in the strata between the layers containing the ancient hearths have been detached from the face of the adjacent hill, as its exposed face weathered under the frost, the wind, and the rain. The débris thus detached from the hill tended to drift down the slope in times of rain, snow, and flood, gradually covering and burying the human habitations, and sealing them up as historical records.

How much older are these Aurignacians of Solutré than the Magdalenians of Chancelade? The beginning of the Magdalenian period has been placed, provisionally, at 13,000 B.C.; the Magdalenian culture was preceded by the Solutrean, which was first recognised at the site we have just described. The Solutrean culture may be given on such evidence as is now available, a duration equal to that of the Azilian or transitional culture—two thousand years. We, therefore, date the end of the Aurignacian period to about 15,000 B.C. Seeing that the Aurignacian

culture is distributed widely in Europe, North Africa, and in the East, that the climate of Europe underwent a marked degree of amelioration and also a retrogression of the ice-sheet during the development of this culture, and seeing that the cave deposits formed during this period are of a great depth, we must allow some five thousand years at least for the duration of the Aurignacian culture in Europe. On this scale of time we date the beginning of the Aurignacian culture about 20,000 B.C., its end about 15,000 B.C. The men of Solutré represent the people who lived in the valley somewhere near the middle of the Aurignacian Saône period—round about the eighteenth millennium B.C.

To examine more fully the characteristics of the men who lived in Europe during the Aurignacian period, we must leave Solutré and follow the valley of the Rhone to the shores of the Mediterranean, and then make our way eastwards along the French Riviera to the neighbourhood of Mentone, particularly to the cliffs and caves which here fringe the coast. A little over a mile to the east of Mentone, just beyond the French frontier, the red rocks of Grimaldi rise from the sea. The caves, where ancient man made a home, open on their southward face about 60 or 70 feet above the level of the sea. A road made along the foot of the cliffs—the Corniche road—serves as a highway between France and Italy. Indeed, many of the caves open just above the road. In 1872, M. Emile Riviere discovered remains of ancient man in some of the Grimaldi caves. Further discoveries were made subsequently, and disputes arose as to their authenticity and antiquity. In 1895, the Prince of Monaco undertook their investigation. He summoned the best talent of France: Canon de Villeneuve to write the historical account; M. Cartailhac to describe the articles of culture; Professor Boule to investigate the geology and the fauna; and Dr Verneau to report on the human remains. Systematic work was commenced in 1895, and by 1902 five great caves and several rock-shelters had been scientifically explored. Between 1906 and 1911 two magnificent volumes, issued in separate

parts, were published at the expense of the Prince of Monaco, thus placing at the disposal of the scientific world a rich and instructive harvest of new facts. Altogether the remains of fifteen individuals were found in the seven Grimaldi caves, but of these only six men and three women were sufficiently preserved for examination. Here we shall deal with those discovered in only one cave —the Grotte des Enfants, so named because the skeletons of two children were discovered in its upper strata.

A summary of what was discovered during the exploration of the Grotte des Enfants is shown in fig. 33. Over 5 feet had been removed from the surface of the cave deposits before the systematic exploration commenced. Twenty-eight feet of accumulations on the original floor still remained. Ten ancient floors were found, marked by hearths and the débris of human occupation; they occurred from the top to the bottom of the cave strata. From the ninth—the second from the bottom—to the highest and most recent hearth, the type of culture was the same—Aurignacian. The ornaments, the implements in stone and bone, were of the same kind as those found in the cave at Aurignac. The remains of the same extinct animals came to light with a few exceptions; the woolly rhinoceros, and apparently the mammoth, never reached the sunny coasts of the Riviera. The remains of the cave-bear, the cave-lion, the cave-hyena, and ibex occurred. In the upper strata remains of the reindeer were found, showing that Arctic conditions had reached the south of Europe during the final phases of occupation. In the very lowest stratum of all, however, were found the remains of a species of rhinoceros, more ancient than the woolly form—the kind known as *Rhinoceros Mercki*. The presence of this southern form in the deepest stratum of the cave, accompanied by remains of the hippopotamus, together with an older form of elephant—*Elephas antiquus*—proves that the Grimaldi caves became inhabited at the close, or soon after the close, of a mild or warm period, during which Neanderthal man occupied Europe. Indeed the lowest stratum

contained stone implements of the Mousterian culture. Thus in the Grotte des Enfants we have deposits, amounting to 33 feet in all, which record the last Arctic phase of

Fig. 33.—Section of the strata of the Grotte des Enfants, near Mentone. (After the section given in Professor Boule's monograph.)

the Pleistocene period—from a time when the French Riviera was warmer than it is in the present day until it fell almost to the temperature of Lapland.

At the level of the second hearth in the Grotte des Enfants, 1·70 m. below the surface, was found the skeleton of an old woman of small stature, but so broken

that a restoration was impossible. It was clear she had been buried, and that ornaments of her time (Aurignacian) had been interred with the remains. At the level of the third hearth, 2·70 m. (9 ft.) in depth, the skeletons of two young children were found, laid on their backs, with heads to the west. At the level of the eighth hearth, 7·05 m. (23 ft.) below the surface, occurred the remains of a very tall man (6 ft. 2½ in.)[1]—a representative member of the Cromagnon race. He was extended on his back, in a grave which had been prepared for him—a slab of red clay under his head, a flat stone over it, large stones grouped round his feet. A worked piece of a deer's antler lay close by; the shells and perforated teeth which formed his necklace were placed near him. The objects of culture were the same as accompanied the men at Cromagnon.

At the level of the underlying ninth and oldest hearth, over 33 feet from the surface stratum of the cave, was found another grave. It contained two skeletons, one of a woman of middle age, the other of a youth of about sixteen. The tall Cromagnon man lay extended on his back, but these short people lay huddled up in the contracted posture. The same kind of provision had been made for them at their death as for the tall man. Stones had been placed to protect the head; the remains of the usual kind of necklaces and bracelets were found; near by were the worked flints of the period. As is so often the case in Aurignacian burials, the skeleton of the lad was stained by red ochre.

It is a feature of the Cromagnon people—the Frenchmen of the Aurignacian period—for the men to be very tall but for the women to be of moderate or even small stature. The little woman found at the level of the second hearth was probably of the same race as the tall man found at the level of the eighth. But what of the lad and the small woman found at the level of the ninth

[1] If the Lee-Pearson formula is used, the height of this man falls to 5 feet 10·6 inches. The stature of the Cromagnon people has been exaggerated.

and oldest hearth? They are the earliest Aurignacian settlers we know of in this part of France—perhaps the earliest yet discovered in Europe. They were buried with all the ceremonies of their culture but within the stratum on which men of the Mousterian period had lit their fires and chipped their tools. Dr Verneau had no doubt about them; in his opinion they represented a negroid race—one not previously discovered in Europe. By a negroid race, we understand one in which the skin is pigmented; as regards the Grimaldi people we have to judge from the skeleton alone. One important negroid feature is absent from both of these Grimaldi skeletons, namely, the negroid contour of the forehead. In pure negroes and in negroid races, the right and left eminences of the forehead—of the frontal bones—tend to fuse together in the middle line so as to form a single eminence of peculiar shape, such as we have seen in a Neolithic skull from Malta (fig. 6, p. 15). In the Grimaldi lad and woman, probably his mother—for they are very much alike—the forehead is of the European form, the frontal bosses are not fused. The skull is long and narrow, as is the case in most negroes, but the same head measurements also occur in white races. When we come to deal with the features of the face, we recognise that there are some negroid traits. The teeth of the lad are very large, causing those in front and the parts of the upper and lower jaws on which they are set to protrude like a muzzle in front of the nasal opening and in front of the chin. The lower margin of the nasal opening as seen on the skull is not sharp as is so often the case in white races, but grooved or guttered as is usual in pigmented races. The face, too, is short, as in most black races. The orbits, although of more than average width, are narrow from above downwards—the upper and lower orbital margins are unduly approximated, giving the face a sinister look. This, we have seen, is also a character of the Cromagnon race. The nose was apparently shaped much as it is in native Australians. These two Grimaldi skeletons, then, do show certain negroid features, and still, to my mind,

a full analysis will prove that they are of the Cromagnon race, or of a people nearly allied to that race.

In the proportion of his limbs, the negro shows certain peculiar features which distinguish him from modern European races. In the first place, his leg is long as compared with his thigh. In the European, the leg bone (tibia) is less than 80 per cent. of the thigh bone or femur; in negroes, the tibia is over 80 per cent., usually between 81 and 84 per cent. In Cromagnon skeletons—from the Paviland cave in Wales, from Cromagnon itself, and from the Grimaldi caves—the tibia varies from 81 to 85 per cent. of the femoral length. In the two negroid Grimaldi skeletons the tibial proportions are 83·8 per cent. for the woman, 83·7 per cent. for the lad. They agree with the Cromagnon race. The same result is obtained when we inquire into the proportion which the forearm bears to the upper arm. In modern Europeans, the radius of the forearm is about 74 per cent. of the humeral or upper arm length; in modern negroes, the proportion of the radius is 79 per cent. The same proportion holds true of the Cromagnon race and of the so-called Grimaldi negroids; the radius of the lad is 79 per cent., that of the woman 85 per cent. of the length of the humerus. The stature of the negroid woman is not low—1·595 m. (5 feet $2\frac{3}{4}$ inches); the lad of sixteen measures 1·560 m. (5 feet $1\frac{1}{2}$ inches). If he had lived he might have added 6 or 8 inches to his stature.

On the palate of the Cromagnon people there is usually a bony elevation—the *torus palatinus*—often seen on the palate of primitive negroid races. The *torus* is present in the Grimaldi negroids. The woman and the lad share the ample brain capacity of the Cromagnon race. The capacity of the woman is estimated by Dr Verneau to have been 1375 c.c., that of the boy 1580 c.c.[1]—both above the modern average.

[1] I have given Dr Verneau's measurements, but to compare them with those made by applying the Lee-Pearson formula, as is usually done in England, 8 per cent. has to be deducted. On our English standard the brain capacity of the woman is 1265 c.c., that of the lad 1454 c.c.

Those Aurignacians had large brains. I am of the opinion that it is a mistake to separate those two Grimaldi individuals, the mother and son, as types of a new race—a negroid race indigenous to Europe. To me these characters suggest that they are only an aberrant Cromagnon form, perhaps primitive, but nevertheless true members of the Cromagnon race. That race, in the proportion of its limbs and in certain features of the face, does show negroid traits. We shall see, as we proceed, that the people who lived in France during the

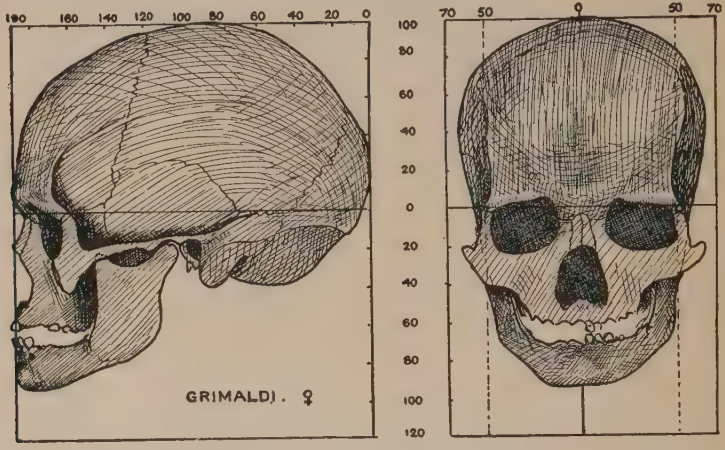

Fig. 34.—Profile and full face of the Grimaldi woman.

Aurignacian period, although often tall, varied widely in stature; we shall find that they differ just as much in head-form as do people of any modern nationality, and that traits, which may be called negroid or primitive, are of frequent occurrence—as they still are among South Europeans. But a full study of the Cromagnon people, as revealed in their skulls and skeletons, has convinced me that they are beyond all doubt of the same racial stock as the modern people of Southern and Western Europe.

When one of the skulls of the Grimaldi negroids is fitted within the standard frame, which we have applied to Neolithic skulls, the fit is seen to be a good one (see

fig. 34). The maximum length of the woman's skull is 191 mm., its width, 131 mm.; the height of the vault above the ear-holes, 115 mm.; the proportion of width to length, 68·5 per cent. Her head was long and narrow. The corresponding measurements of the lad's skull are: length, 192 mm.; width, 133 mm.; height, 125 mm. The width of the skull represents 69·2 per cent. of the length. The chief point of difference between the typical Cromagnon skulls and those of the two negroids lies in the characters of the cranial vault. The flattening of the vault seen in Cromagnon specimens is absent in the negroid skulls. The vaults are raised as in negro skulls.

The presence of negroid features in these early Europeans sends the mind seeking for the cradle of the Cromagnon stock in the direction of Africa to the fertile lands of the old Sahara pictured in Chapter II. Later on, when treating of Malta, there will be occasion to discuss the existence of a former land-bridge across the Mediterranean, by which these people may have passed from Tunis to Italy. In the meantime there is one very primitive feature of the Grimaldi lad which deserves mention. His teeth and palate are of remarkable size. The last molars or wisdom teeth were in process of eruption at the time of his death, but in fig. 35 they are shown in place within the dental series. It will be seen that the palatal or chewing area, as measured in fig. 35, has a total length of 65 mm., nearly 15 mm. longer than is now the rule in modern Europeans. Its width, measured between the outer surfaces of the second pair of molar teeth, is 65 mm., only 2 or 3 mm. more than is usual amongst modern European men. The length, as in anthropoid palates, is long compared with the width. If we measure the area contained within the outer circle of the teeth, as may be done by drawing an outline of the palate on millimetre paper and counting the number of squares thus included, we find, in the case of the Grimaldi lad, that the area is 39 cm.^{2}, whereas the palatal area of an average modern Englishman is a little under 25 cm.^{2}.

We know that, during the earlier stages of the evolution of man, while the brain tended to increase in volume the area of the palate tended to decrease. Later on we shall discuss the relationship which exists between area of palate and volume of brain (p. 215). In the meantime it is sufficient to state that, while in modern British skulls the area of the palate to the volume of the brain is as 1 : 59, in

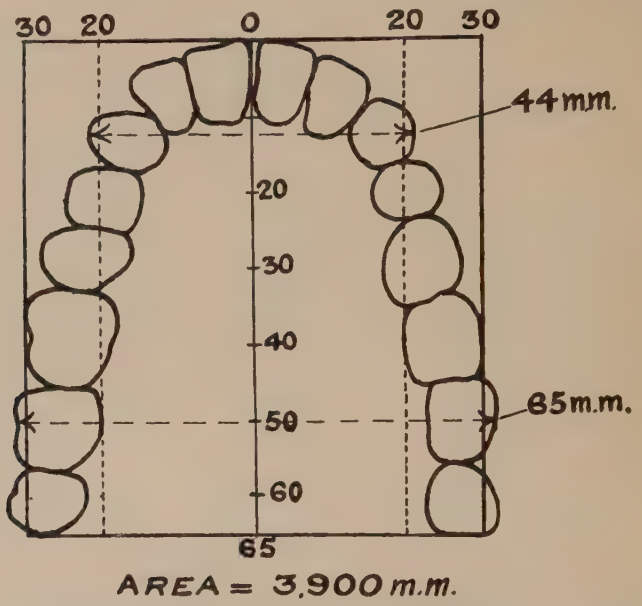

Fig. 35.—The upper teeth and palate of the Grimaldi lad, to show their size and to explain the method of estimating the palatal area.

the Grimaldi lad it was as 1 : 37. In the chimpanzee the palato-cerebral ratio is as 1 : 9·2. Latter-day civilisation has led to a decrease in the area of the palate, but there is no evidence of a corresponding increase of brain. The Grimaldi lad had reached our modern standard of size of brain, but in area of palate he measured half as much again as we do.

Having thus seen the kind of people who lived on the shores of the Mediterranean during a long and varying phase of the Ice age, and shared in the Aurignacian

culture, we again set out on our tour of Ancient Europe. To return to the Dordogne so that we might examine the locality and grave in which the man of Combe-Capelle was found—one of the earliest representatives of the Aurignacian people yet discovered—would be inconvenient at this point, besides involving us in a journey of 400 miles. In any case an account of this important discovery will fit in more conveniently on another occasion (p. 165). We therefore make our way to the north, beyond the Alps, to the plains of Moravia, now included in Czecho-Slovakia. The town of Brünn, situated on these plains, which ultimately send their waters southward to the Danube, is 600 miles from Mentone. Discoveries made along the valley of the Danube and those of its tributaries have shown that the men who dwelt in the central parts of Europe, although they had adopted the Aurignacian culture, had modified it in so many details that in their hands it had ultimately evolved into that form of culture to which the name "Solutrean" has been given. We have already come across this culture in the upper strata of the rock of Solutré; it there ousted and succeeded a typical form of the Aurignacian culture. The land to which we have come may therefore, on the basis of our present knowledge, claim to be the cradle of a new culture —the Solutrean.

The kind of man who lived in Moravia in the later phases of the Ice age, and modified Aurignacian fashions, was first brought to the light of day under the following circumstances. In 1891, a canal was being made in Brünn, the capital of Moravia, some sixty miles north of Vienna, when a human skull was found at a depth of 15 feet. In the same stratum, and near the skull, were found objects of culture—perforated shells and an ivory image—and the remains of the extinct animals—the mammoth and woolly rhinoceros—which usually accompany Aurignacian man. The same ancient culture which we saw in the deposits of the cave floor at Aurignac extended to Wales and to Moravia. When the Brünn skull—the larger of the two described by Professor

Makowsky [1]—is placed in a standard frame (fig. 36) we are impressed by its dimensions. The maximum length is 206 mm., its width, 144 mm.; the height of the vault above the ear-holes, 125 mm.; the width is 69 per cent. of the length; the capacity, estimated by the Lee-Pearson formula, a little over 1600 c.c. It is a man's skull, showing strong and rugged characters in the forehead and in the area for attachment to the neck. The Brünn type may be regarded as a variant of the Cro-magnon—the man was apparently a member of an allied race. On my visit to Jersey,[2] I was surprised to find in the museum of the Société Jersiaise a skull which was a

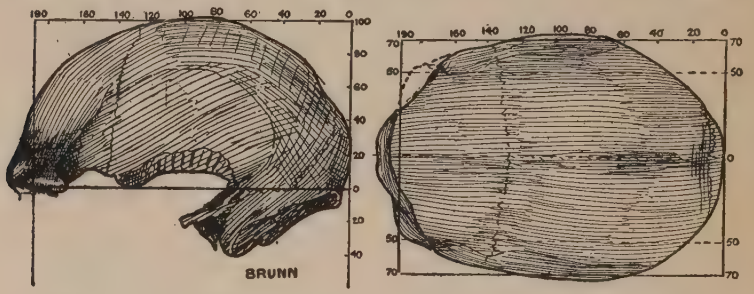

FIG. 36.—The Brünn skull (No. 1) from the side and from above.

replica of the Brünn example. All that is known of the Jersey specimen is that it was brought from South America. As is so often the case with the Aurignacian skulls, the Jersey skull is of a brownish-red colour, as if it had been embedded for a long time in soil rich in iron.[3]

Fifty miles to the east of Brünn—near to the town of Prerau, and beyond the battlefield of Austerlitz, is the

[1] "Der diluviale Mensch in Löss von Brünn," *Mitth. Anthrop. Gesellsch. in Wien*, 1892, vol. xxii. p. 73.

[2] See *Bull. Soc. Jersiaise*, 1913, vol. xxxviii. p. 310.

[3] In late years I have seen several similar examples from Patagonia, but the face of the Patagonian skulls differs from that of the European. I have seen similar crania from Neolithic sites along the Mediterranean, but in these cases the facial conformation was entirely European. One cannot make a reliable diagnosis of racial affinity on the characters of the brain-containing part of the skull alone.

most famous of all Moravian settlements of ancient man —Predmost (fig. 37). Here, as at Solutré, rises up a rocky elevation, covered and surrounded by silts, loess, and gravels, deposits laid down during the later phases of the Ice age. On the shoulder of this elevation, buried under the deposits of the glacial period, have been found the hearths, home, and dead of the native people of the distant period

FIG. 37.—A sketch map to show the chief sites at which discoveries of ancient man have been made along the valleys of the Rhine, Meuse, and Danube.

with which we are now dealing. Their chief prey was not the horse, as at Solutré, but the mammoth; in one stratum the bones of this animal are massed in hundreds. Over 30,000 flint implements have been gathered from the site; they are worked in the Solutrean manner. In one stratum were grouped in regular order, as if in a common grave, the remains of over forty individuals—men, women, and children. They were a long-headed folk, and in stature they almost rivalled the men of Cromagnon. Dr K. Absolon, curator of the Government Museum in Brünn, has shown me photographs of

wonderful ivory beads, of small statuettes of fat women carved out of mammoth tusks, of bone and stone implements in great variety, but all conforming to a late Palæolithic type. Thus in the Ice age, the plains of Moravia had their population of tall, long-headed men, skilled in hunting, and showing a high degree of artistic development.

From Brünn we have now to make our way westwards, to the upper waters of the Danube, and then down the Rhine to the old university town of Bonn, situated on the left or south bank of the river, to witness one of the most important of recent discoveries of ancient man. We have left Brünn some 450 miles to the eastward ; the shores of the North Sea lie 160 miles to the west ; Düsseldorf, the point of departure for Neanderthal, is forty miles farther down the Rhine. On the opposite or northern bank, just above Bonn, is the village of Obercassel ; there the north bank of the Rhine rises up steeply and is marked by terraces—old beds of the river. In February 1914, the quarrymen of Obercassel were extending a pit which revealed sections of two of the old terraces—the " high " and " highest." It was seen that the " highest " terrace at one time had presented a steep face to the river and would have provided shelter for men living on the terrace just below—the " high " terrace. On the platform of this latter terrace was exposed a stratum, only 4 inches thick, which contained bones—implements worked and engraved, with other objects fashioned by ancient man, all of them representative of the Magdalenian culture. Over this stratum had accumulated some 13 feet of sand, detached from the crumbling sheltering face of the " highest " terrace. The accumulated material had covered and preserved this habitation of Rhinelanders of the Magdalenian period. In the stratum lay the skeleton of a man and a woman side by side ; the bones were stained red from the ochre which had been used in the burial service. The skulls and skeletons were presented by the owner of the quarry to the University of Bonn ; an account of these Magdalenian people and of

the circumstances of their discovery has been published by Professors attached to the University.[1]

In fig. 38 is shown the skull of the man of Obercassel in profile and in full face. Those familiar with the head-form of the ancient and modern people of Scandinavia, will recognise at a glance that we have here an unmistakable representation of the Nordic type—the first glimpse we have yet got of the type of man which is still dominant in North-Western Europe. The man of Ober-

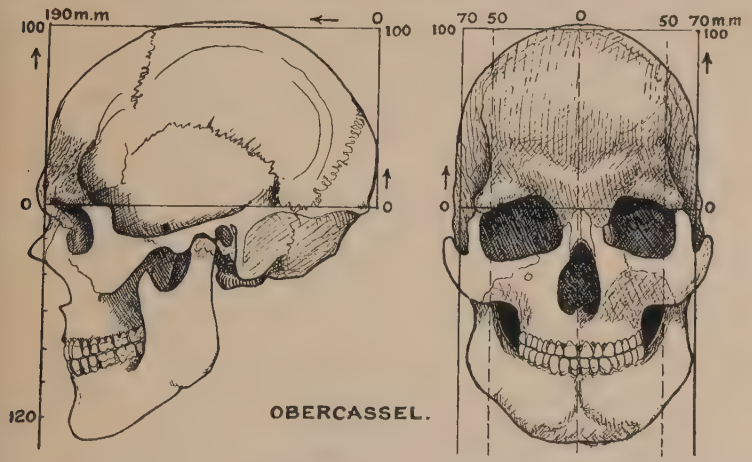

FIG. 38.—The skull of the man of Obercassel in profile and in full face. (After Bonnet.)

cassel, however, was not tall—only 5 feet 3 inches (1600 mm.); his head was large, the skull measuring 194 mm. in length, 144 mm. in width; the width being 74·6 per cent. of the length. The roof is relatively low-pitched—rising 115 mm. above the ear-holes. The cranial capacity may be estimated at 1500 c.c. Not only are these measurements such as are often met with in Nordic skulls, but the details of conformation are also Nordic. The woman was young, probably twenty years of age; about 5 feet 1 inch (1550 mm.) in stature; her head was of a medium size—184 mm. in length, 129 mm. in breadth,

[1] M. Verworn, R. Bonnet, G. Steinmann, *Der diluviale Menschenfund von Obercassel bei Bonn*, Wiesbaden, 1919.

the breadth index being only 70—narrow and long-headed. The cranial capacity was 1350 c.c.—about 50 c.c. above the average for modern women of the Nordic type. That she, too, conformed to the Nordic type there can be no doubt.

The conformation of face, as has already been pointed out, is a more reliable indication of breed and of race than is the shape of cranium. The man shows the Nordic face in its most robust form. It is long, and when we note in its profile (fig. 38) the strongly developed shelf-like chin, the high-pitched nose, the teeth set regularly in an arch of modern size, and the complete absence of any muzzle-like projection of the jaws, we see we have in this ancient Rhinelander a fine and full-blown representative of the Nordic stock. As we survey him in full face there are two outstanding features which seize our attention—the great breadth and strength of his zygomatic arches (he had a bizygomatic diameter of 153 mm.), and the outward projection of the angles of his lower jaw —his jowls. At this part his face had the great width of 128 mm. All of these features betoken chewing muscles of enormous strength. In the woman, on the other hand, the cheeks had the flatness seen in modern women of the Nordic type. It is a noteworthy fact that the round-headed "beaker" men who invaded the eastern coast of Britain late in the Neolithic age, and certainly came from the north-west of Europe, had a facial development identical with that of the Obercassel man. In the earliest inhabitants of Scandinavia the cheeks and jowls have seldom the great dimensions just described; but that they were of the same lineage as the people who lived in the Rhine valley during Magdalenian times there cannot be a doubt. The discovery at Obercassel may be regarded as proving that men of the Nordic type were already in possession of North-Western Europe in the last phase of the Ice age—as early as the twelfth millennium B.C., and we may regard—so far as our experience goes—this part of Europe as the cradle in which the Nordic type was evolved.

We have to leave Obercassel and retrace our steps to the upper waters of the Danube—to the higher lands on the boundary between Bavaria and Würtemberg. Here, some fifty miles to the south-west of Nürnberg, is the cave of Ofnet which Dr R. R. Schmidt began to investigate in 1901. The strata which Dr Schmidt found in the floor of the cave are shown diagrammatically in fig. 40. All the later Palæolithic cultures are represented in the deeper strata of the cave —Aurignacian, Solutrean, and Magdalenian; so is the

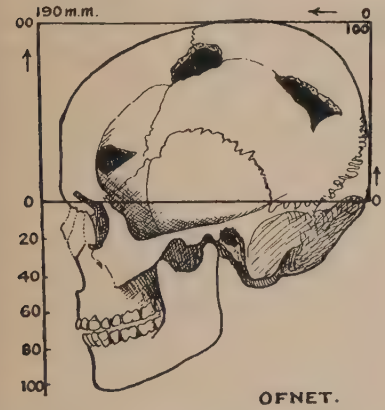

FIG. 39.—The skull of a round-headed woman from the cave at Ofnet.

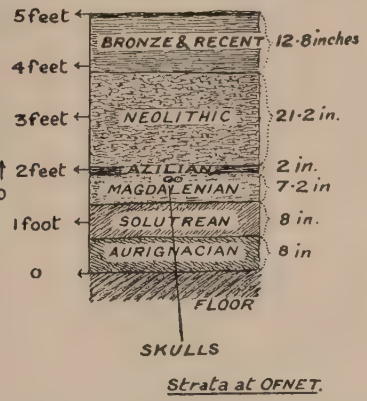

FIG. 40.—The sequence of strata in the floor of the cave at Ofnet.

Azilian or transitional period. The upper strata had been trampled down by men of the Neolithic and Bronze ages. In 1907 Dr Schmidt[1] made a discovery which throws light on certain strange burial customs practised by the people who used this cave in Azilian times. Under the Azilian stratum were two caches of skulls, 27 in one, 6 in the second, arranged in orderly circular rows. The skulls belonged to people of all ages and of both sexes; they were powdered and stained with red ochre. Mingled with them were perforated shells, stag's teeth, and other sure marks of the Azilian culture. What the meaning of

[1] R. R. Schmidt, *Die diluviale Vorzeit Deutschlands*, Stuttgart, 1912 (Anthropology by Dr A. Schliz).

this peculiar burial custom may be we shall not stop to inquire; the main interest lies in the kind of people who were represented in this treasure-trove of skulls. They are clearly later in date than the long-headed type we have seen at Predmost and at Obercassel. Of the 21 skulls sufficiently preserved to give a guide to head-form, 8 were of the rounded cranial type, 5 were long, and 8 of an intermediate form. The skull of a woman—a good representative of the round-headed type—is shown in fig. 39. Its length is 174 mm., its width 136 mm., the latter being 78·2 per cent. of the length. Although the width falls short of the 80 per cent. of length which entitled a skull to be grouped as brachycephalic, yet in its conformation—its vertical hinder end and flat roof—it has the conformation of this type. The face is strongly built, but is short relatively and rather wide and flat. The discovery at Ofnet tells us in an unmistakable manner that the revolution in head-form, which was destined to spread so widely in Europe, had already set in at the close of the Palæolithic period—perhaps at a much earlier date. The people of Ofnet were mostly round-headed. There are many varieties of round skulls; the skulls of Ofnet are of the bullet-like or Mongoloid form—quite unlike the Armenoid type of Asia Minor. The long-headed element represented in the collection of skulls at Ofnet is of the Nordic type. At Ofnet, then, we seem to come across a mingling of two peoples, and the round-headedness of the one element has dominated and submerged the long-headedness of the older type. In the modern population of Central Europe, round-headedness, as already mentioned, has become dominant everywhere.

The round-headed Ofnet type must have made its way to the west of Europe before the end of the Ice age. Exact replicas of these Ofnet skulls were found in the Magdalenian stratum of a cave near Furfooz, in Belgium (see fig. 37), in 1867; Dr Mendes Corrêa has found them in the most ancient Neolithic shell-heaps of Portugal; we have seen skulls of a very similar type in the Aurignacian

strata of Solutré; a skull of a similar kind was discovered by Dr von Luschan in a deposit of late Palæolithic date at Nagy-Sap in the valley of the Danube. It was these same round-headed people who established the oldest pile-dwellings on the lakes of Switzerland.

Having thus made the round of Europe in search of the kinds of men who lived and evolved upon its lands during the later and varying phases of the Ice age, we must now make our way back to England to apply the knowledge we have gathered. It will repay us, however, to make a detour northwards to the large Danish island of Zeeland, lying in the mouth of the Baltic. The very modern city of Copenhagen is built on its eastern shore, while along its western coast are peat mosses which contain traces of settlements made by the men who followed hard on the retreating edge of the ice-sheet. The pioneer settlers of Scandinavia fashioned bone harpoons in the Azilian manner, but their art and way of living differed from those represented by the culture of the south. At Maglemose on the west coast they lived on a raft-village built on a lake, and had to row or swim 350 yards to reach it from the shore. Their arrival in Denmark is dated on reliable evidence to the sixth millenium B.C. So far no skull or bone of these Maglemose or harpoon people has been found, but one may infer that they were of the same stock as the people who lived at Obercassel—400 miles to the south of Zeeland. As far back as we can trace man in Scandinavia we find the Nordic type in possession of the country.

Our interest in the Maglemose or harpoon people lies in this: on the east coast of Yorkshire, just north of the Humber, and 450 miles across the North Sea from Maglemose, Mr A. Leslie Armstrong[1] has found bone harpoons worked in exactly the same manner, and flint implements of various kinds fashioned in the same way as those which are found at Maglemose. If the reader will glance at the map of the North Sea (fig. 15), he will see that in the early part of the Neolithic period a shore

[1] *Man*, 1923, vol. xxiii. p. 135.

journey round the North Sea gulf would give the harpoon people access to northern England. The Maglemose culture spread through the north of England; it has been found by Sir William Boyd Dawkins in the floor deposits of the Victoria cave at Settle, just on the borders between Yorkshire and Lancashire. It has been found at various places in the south of Scotland, but the most remarkable site of all is that investigated by Mr A. Henderson Bishop [1] in the island of Oronsay in 1913. This small island and its larger northern neighbour, Colonsay, lie on the west coast of Scotland, forty-three miles from Oban. To reach the island, even now, a stretch of sea ten miles in width has to be crossed, but at the time the harpoon people settled on it and heaped the refuse of their feasts of shell-fish and of game on the beach the sail must have been longer, for in Azilian times the islands and the neighbouring mainland stood 30 feet deeper in the sea than at present. These ancient people of Oronsay hunted deer on the adjacent islands and on the mainland. We have evidence at Maglemose and at Oronsay that the harpoon people, whom we infer to have been of the Nordic stock, were manifesting their inborn aptitude for the sea at least as early as the beginning of the Neolithic period.

No skull or trace of the body of the harpoon people has been found in the ancient shell-heaps of Oronsay. But it is possible that a skull discovered in the M'Arthur cave at Oban in 1894, and described by Sir William Turner,[2] may be of the same stock. The cave had been occupied by the harpoon people; ample traces of their habitation had been found in a stratum of the floor of the cave, 3 feet in depth. The cave was discovered accidentally in 1894. The cliff in which it occurs had been worked for building stone; an extension of the quarry laid open this habitation of ancient man. Its original entrance had been closed by a fall of rock from

[1] A. Henderson Bishop, *Proc. Soc. Antiquaries of Scotland*, 8th December 1913.

[2] *Proc. Soc. Antiquaries of Scotland*, 1895, vol. xxix. p. 410.

the face of the cliff—apparently at a remote but uncertain date. A skull was found on the floor of the cave—not buried in it. Its condition is in favour of its being of ancient date. This skull is very similar in form and size to that of the man of Obercassel, save that the face is narrower and longer, the zygomatic arches and angles of the jaws being less prominent. It will thus be seen that soon after the close of the Ice age a people probably of the Nordic type, and practising a civilisation of the Maglemosian type, was scattered on the shores of North-Western Europe, from the Baltic to the Hebrides.

CHAPTER VI

ENGLISHMEN OF THE LATER PALÆOLITHIC PERIODS

In this chapter we again return to England to take up the story of ancient man. Our object is to see what traces have been discovered of the various cultures revealed by the caves of France, and specially to ascertain what kinds of men lived in England before the days of Neolithic man. The scene of our first inquiry is again in the south-east corner of England, in the county of Kent, and within a few miles of the Megalithic monument at Coldrum described in the first chapter. From Coldrum, we must follow the Medway northwards as it leaves the Weald to enter the valley in the North Downs by which it reaches Rochester and Chatham and finally ends in the estuary of the Thames (fig. 1). Within this valley, and on the western side of the Medway, is the busy little town of Halling, robbed somewhat of its ancient picturesqueness by the invasion of cement works, which throw a pall of smoke, obscuring our view of the rising domes of the Downs. Opposite Halling the Medway is banked; at high tide the barges with their large brown sails seem to float some feet above the level of the wide stretch of marshland—half a mile wide—which separates Halling from the river. Between Halling and the marsh, however, is a natural terrace—8 feet above the level of the marsh and 15 feet (4·5 m.) above the zero level of the Ordnance Survey (Ordnance datum). The terrace follows the margin of the marshy floor of the valley as if it represented an ancient bank of the Medway, which it probably does. It was in this natural

terrace, at a depth of 6 feet (1·8 m.), that a human skeleton was found—the skeleton of the Halling man. The evidence, we shall see, leads us to the conclusion that this man belongs to one of the later periods of Palæolithic culture. His horizon in time lies in that phase of the earth's history which geologists term the Pleistocene epoch.

The discovery of the skeleton came about in this way. In 1912, Halling required a new drainage system, and in August of that year, the terrace of brick earth on the edge of the marsh was excavated to form a large sewage tank. The working face of the trench was 11 feet in depth (3·4 m.), exposing nine strata, all laid down in running water, the various superimposed layers being clearly differentiated. As the men worked, a slip of earth occurred from the side of the trench, exposing parts of a human skeleton embedded in the fifth stratum from the top, and lying 6 feet (1·8 m.) from beneath the surface of the terrace. As the fall of earth occurred a labourer caught the skull in his hands. The brain space was filled with a firm cast of fine loam or brick earth, similar to the deposit in which the skeleton lay. By a happy chance, part of the skeleton remained embedded in its place on the bank. It was also a fortunate circumstance that the scientific study of early man finds a home in the valley of the Medway. The engineers in charge of the works were alive to the importance of the discovery, and called in Dr Spencer Edwards and Mr W. H. Cook, active members of the Medway Valley Scientific Research Society. They proceeded at once to investigate and to record all the circumstances connected with the discovery. They examined the strata (fig. 41) overlying the skeleton, and found they were unbroken and undisturbed. No one could assert that the skeleton had been buried from the present surface of the terrace, for the demarcating lines between the strata were sharp and unbroken. Dr Edwards observed, from the position of the bones which still remained in the bank, that the body had been laid on its back, but turned

slightly so as to lie on the left arm. Amongst the ribs, which had fallen out in a mass of brick earth, lay the lower jaw, showing that the head had been bent on the breast. The leg bone lay near the shoulder blade, showing that the lower limbs must have been flexed on the trunk. The body must have been in the flexed or contracted posture, for the extreme parts of the skeleton were less than 3 feet apart.

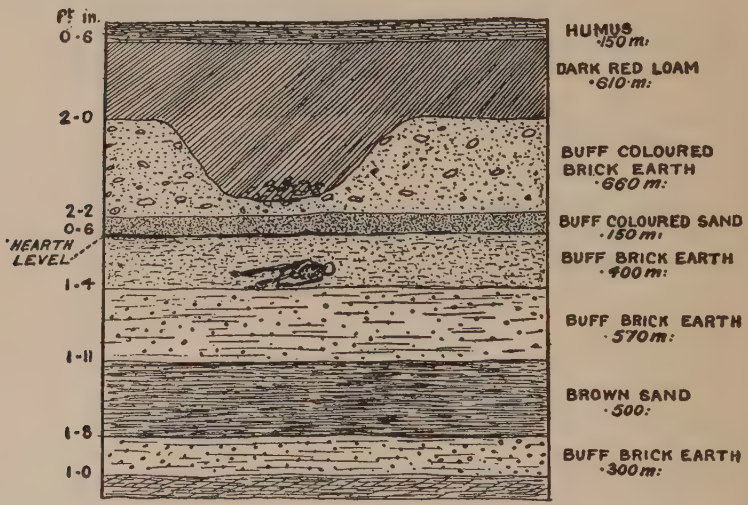

FIG. 41.—A section of the strata at Halling, showing the position of the skeleton. The dip in the second stratum, over the skeleton, marks the bed of a buried stream. (After W. H. Cook.)

As they proceeded in their investigation an extremely important discovery was made—one which reminds us of the buried Palæolithic hearths discovered in the open country at Solutré. In another part of the trench, a long black stratum was exposed between the deposit in which the skeleton lay, the fifth layer, and the overlying or fourth deposit (fig. 41). In the black intermediate zone, there were unmistakable traces of ancient hearths —charcoal, flints splintered by heat—"pot-boilers," chipped flints, worked implements, bones of animals. It was clear, from this discovery, that an old land surface was represented by the black zone between the fourth

and fifth strata. The strata over the black zone were unbroken; the skeleton which lay in the fifth stratum was evidently the remains of a man who had lived on the old land surface, had sat round the ancient hearths, and ultimately had been laid in a superficial grave before the upper four strata had been deposited. This was the only reasonable explanation of the facts.

The question which then presented itself to Mr Cook [1] was: How old is that land surface? He collected all the flints and animal remains which were to be found on it and below it. The assemblage of implements represent, in the opinion of experts—of M. l'Abbé Breuil, Mr Reginald Smith, Mr Reid Moir—a "late cave period," which may mean one anywhere between the Aurignacian and Azilian cultures mentioned in the last chapter. Further discoveries point definitely to the age of the Halling hearths as Aurignacian—the same age as Paviland and Cromagnon—and therefore lying well within the Pleistocene period. Hence the Halling man must be assigned to one of the closing phases of the Ice age.

It is important, before inquiring into the physical appearance of the Halling man, to fix as nearly as possible his horizon in time. The flint implements which were found in and round the hearths, covering the land surface under which he was buried, suggest the Aurignacian period. A flint flake with an engraving on its cortex lay on the same stratum, but the carvings in bone and in ivory, the necklaces of perforated shells and teeth, which characterise this period, were not found. If the date is such as has been suggested, then in those brick earths of the terrace we should find remains of extinct animals, such as the mammoth, the woolly rhinoceros, and reindeer. The remains of this fauna were not found at the actual site of the burial, but they do occur in the same deposits on a neighbouring part of the Medway valley.[2]

[1] In his geological investigations Mr Cook had the help of an expert geologist, Mr J. A. Bullbrook.

[2] W. H. Cook, *Transactions of the South-Eastern Union of Scientific Societies*, 1923, p. 67.

The corresponding terrace on the opposite or eastern side of the Medway valley (fig. 43), a counterpart of the Halling terrace, yields abundant remains of Pleistocene animals. In the opinion of Mr A. S. Kennard, who must be regarded as one of our highest authorities on the age and nature of English valley deposits, the brick earths of the Halling terrace do belong to the Pleistocene period. All the evidence, then, if not definitely proving, at least gives us a very high degree of assurance in regarding Halling man as of the Aurignacian age.

In our survey of Neolithic man in England, the Tilbury skeleton represented the most remote in point of time. That skeleton lay 34 feet beneath the submerged marsh

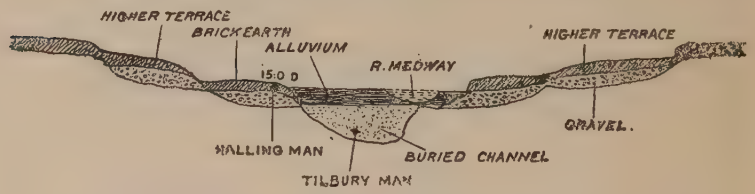

FIG. 42.—Diagrammatic section across the deposits in the valley of the Medway to show the relative position of the Tilbury to the Halling skeleton (W. H. Cook).

surface in the adjoining Thames valley. The Halling man lay in a deposit of brick earth which rises 7 feet above the level of the marshy floor of the Medway. What were the changes which occurred in the neighbouring valleys of the Medway and Thames between the times of the Tilbury and Halling men? In the first place, we must examine, as Mr W. H. Cook and Mr J. A. Bullbrook have done,[1] the nature and formation of the Halling terrace. We have already seen that there are at least nine distinct strata in the terrace. Each of these denotes a phase in the action of the Medway—its condition of flood, the nature of the débris it was scouring off the face of the Weald and depositing on its bank at Halling. It is also apparent that in order to have the strata deposited one above the other, either the waters of the Medway

[1] See *Journ. Roy. Anthrop. Instit.*, vol. xliv., July 1914.

came down in greater and greater volume, or, as is more likely to have been the case, the land was sinking at the time the terrace was being formed. There was then in operation a process of submergence, with filling up of the valley. The subsidence could not have been continuous, for under the fourth deposit from the top is the old land surface on which Palæolithic man made his hearths. Eventually that land surface became covered with 5 feet of deposit, and then the formation of the terrace ceased. We know why the formation ceased. Under the valley of the Medway, recalling the condition seen in the adjoining valley of the Thames, is the old buried channel of the

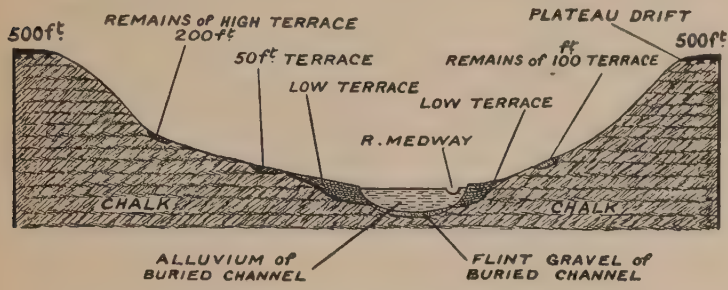

FIG. 43.—Section across the Medway valley from west to east, to show the position of its various terraces (W. H. Cook).

river. Its bottom lies about 60 feet below the level of the Halling terrace. We have seen that it was about the commencement of the Neolithic period that the land reached its highest point of elevation; it was then that the Medway occupied its buried channel. It is thus apparent that the formation of the Halling terrace must have ceased when the process of elevation set in—the process which culminated in the Medway carving out the valley to the depth of the buried channel. If Neolithic man appeared when the land had reached its highest point of elevation, and when the Medway had reached its lowest bed, he would have found the Halling terrace, not as we see it to-day, only a few feet above the level of the tide, but on the sides of the valley, 40 feet or more beyond the reach of the greatest floods. Tilbury man did not

appear at the point of greatest elevation; submergence was well under way—the river valley was being submerged and filled up when he was living. Since his day, submergence had proceeded, bringing the Halling terrace almost back to its original level as regards the river bed. Now, it is plain that if we allow five or six thousand years for the antiquity of the Tilbury man, we must, if we count by the rate of elevation or submergence of the land, allow much more than that period to cover the time which elapsed between the Halling and the Tilbury men. After Halling man was buried, the terrace went on forming; then ensued a period of elevation, during which the Medway deepened its valley by 50 feet or more. Then the submergence began; at an early phase of the submergence, Tilbury man appeared. It seems to me that a period of at least eight or ten thousand years must be allowed for the Halling-Tilbury interval. Our inquiries into the cave formations showed us that the depth of the deposits formed during the later Palæolithic periods may amount to as much as 60 feet; we saw, too, the succession of various forms of cultures, the extinction of many animal species, and a great change in climate. But we had no opportunity of forming an estimate of time by such means as we find at Halling—the work done by rivers, the deepening and the filling up of valleys. I do not see, when we take all these considerations into account, that we can allow less than twelve or fifteen thousand years as the age of the Halling skeleton. Such an estimate is in keeping with the antiquity usually assigned to the Aurignacian culture.

We now turn to ascertain what kind of man lived so long ago in the Medway valley. We have seen what the Aurignacian men of the Continent were like—the tall, lank, rather negroid Cromagnon people, the robust, large-headed Brünn type, the river-bed type of Engis, the Nordic type at Obercassel, and the round heads of Solutré and Ofnet. At Halling, we again meet with the river-bed type of skull. In fig. 44, this skull is placed within a standard frame, designed to fit the average-sized

head of to-day. It is seen to fit the Halling skull very closely. The length of the skull is 187 mm.—3 mm. short of the conventional standard ; the width is 142 mm., being 75 per cent. of the length ; the height of the vault above the ear-holes is 124 mm.—nearly 9 mm. above the mean amount for males.[1] The size of the brain was, as is so often the case in Palæolithic races, above the modern average—the cranial capacity in this case being 1500 c.c. The measurements cannot be regarded as exact, for,

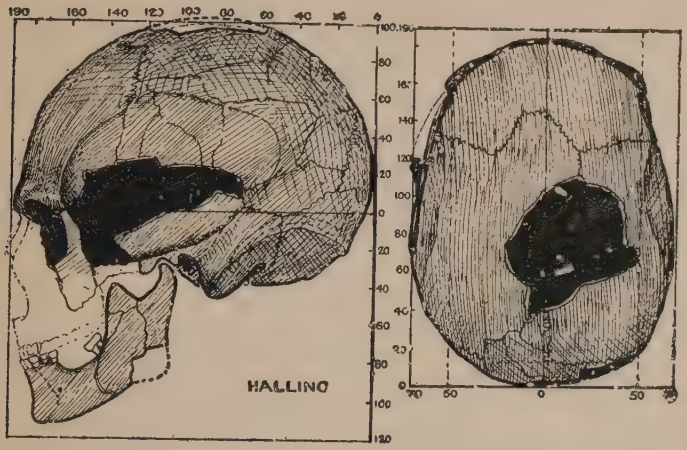

FIG. 44.—The Halling skull viewed from the side and from above. The suture across the skull—the coronal suture—is anomalous in its forward projection.

although the cavity of the skull was filled with a solid cast of brick earth, yet all the bones were much broken, and, in the replacement of fragments, some degree of error may have crept into the reconstruction. There is not a single feature of the skull which one can say is primitive or ape-like. The forehead is well formed, of average size, with supra-orbital ridges moderately developed. The areas for the muscles of mastication are not larger than in modern skulls. The bones which enclose the brain cavity, often 8 or 10 mm. thick in

[1] For full account of skeleton, see *Journ. Roy. Anthrop. Instit.*, vol. xliv., July 1914.

ancient skulls, are in the vault of this specimen only 4 to 5 mm. thick—in reality thin bones. The mastoid processes and other areas of the skull to which the muscles of the neck are attached do not differ in any point from those seen in modern races. Indeed, were it not for the evidence of the strata in which the skeleton lay and the hearths which were superimposed, and particularly the condition of the bones themselves, one would not have suspected that this was the skull of a man who lived many thousands of years ago. The bones when originally found were soft; when dried they became hard, porcellanous, and brown in colour. Now they have become of a light, stone-grey colour, with absolutely no animal matter left in them. When placed in dilute hydrochloric acid, they crumble into a fine, grey sediment.

Of the face, no clear picture can be drawn. All the bones between the lower jaw and the forehead had become dissolved away in the brick earth. The dimensions of the lower jaw suggest a face of moderate length, contracted at its lower part, especially at the jowls or angles of the mandible, in front of and below the ears. The chin is moderately developed, narrow and peaked in shape; the height of the mandible at the symphysis is 30 mm., its thickness, 14 mm.—both moderate dimensions. The width between the angles of the jaw was 96 mm.; the bicondylar width, 120 mm.—measurements which the expert anatomist will recognise as moderate for even present-day men. The zygomatic or cheek arches were broken, but the total width of the face could not have appreciably exceeded the modern average.

The characters of the skull and skeleton leave no doubt as to the sex: the skeleton was that of a man, and from the condition of the sutures between the bones of the skull—all of which were open—a man not over forty years of age, probably considerably under. For a man of this age the teeth were in a surprisingly bad condition. They were deeply worn; the enamel had disappeared by wear from the chewing surfaces of the crowns, exposing

the dentine, and, in some cases, the pulp cavities. Of the six molar teeth of the lower jaw, five had been lost from disease—not from caries, but from abscesses or gumboils forming at their roots. One of the premolar teeth had also perished before death; the incisors, canine, and premolars, some of which had fallen out after death, were much worn. The food of the Halling man was rough in nature, and he had suffered severely from dental disease. It was possible to estimate the size of his palate. It was rather shorter and wider than is common in modern Englishmen. A feature altogether unexpected in a primitive jaw is the position of the third molar or wisdom tooth. It springs, as may be seen from fig. 44, not from the body of the jaw, but from the root of the ascending branch of the mandible, indicating that there was insufficient growth in the jaw to provide accommodation for the last tooth to come into its proper position. As regards the dimensions of the teeth, such of them as have been preserved, there is no point in size or form which differentiates them from the teeth of modern British people. The criticism may be made that such a skull is of no intrinsic interest because it shows no new or primitive feature. On the contrary, the discovery is of the greatest interest; it shows how steadfastly human characters are transmitted from generation to generation. If we accept the degree of antiquity I have presumed—some fifteen thousand years—and allow forty generations to each thousand years, then we see that racial characters can be transmitted for six hundred generations, and still retain their essential features almost unchanged.

Mention has been made already of the broken condition of the bones of the skull. The bones of the skeleton, in spite of the greatest care, could not be reconstructed with absolute accuracy. The shafts of the long bones, which are always dense and compact in structure, were preserved, but the spongy texture at their extremities had become reduced to dust. The thigh bones were fairly complete. Their total length was approximately 435 mm. Applying

the formula used by Professor Pearson for calculating the stature of the individual from the length of the thigh bone, we estimate the height of the Halling man at 1630 mm. (5 feet 4 inches)—somewhat under medium height. His collar bones were also short, 130 mm., but stout, indicating a man with a narrow, round chest. The ribs were broad and strong. Clearly the Halling man was not of the tall, Cromagnon breed. His low stature agrees with that of the Neolithic river-bed people. Yet he differed from them in certain features. In Neolithic skeletons, the upper extremity of the thigh bone usually shows a marked degree of flattening from front to back. In the Halling thigh bone, as is the case in many continental skeletons of a Palæolithic date, this feature is absent.[1] The thigh bone in this respect is also like that of modern man. The head of the thigh bone of the Halling man is very massive—52 mm. in diameter, an excessive amount when one considers the shortness of the bone. His tibia does not show the compression or flattening from side to side which appears in races of Neolithic and later times. In this respect also, the tibia approaches more nearly to that of modern man. We have seen, too, that in the proportion of the limbs the Cromagnon type resembled negro races, the tibia being very long when contrasted with the femur, and the radius long when compared with the humerus. Unfortunately, the extremities of nearly all the long bones were deficient in the Halling skeleton, precluding an exact estimate of their lengths, but one can be certain that these negroid features were not present—at least not in the marked negroid degree found in the Cromagnon men of the Aurignacian period.

One very anomalous and puzzling feature was found in the vault of the skull (see fig. 44). The coronal suture which crosses the vault between the frontal and parietal bones bends towards the forehead as it approaches the middle line of the vault. So anomalous is the con-

[1] Details of measurements will be found in the *Journ. Roy. Anthrop. Instit.*, vol. xliv., July 1914.

dition that, at first, it seemed most likely to arise from an error in reconstruction. A full investigation excluded such an explanation. In one of the Neolithic skulls found at Coldrum, a large Wormian bone was interpolated in the same part of the vault (see fig. 4, p. 10). In the Halling skull, the irregularity may arise from the presence of such a bone, which has become joined to the left parietal bone. It is a remarkable circumstance that one should find two ancient skulls from neighbouring localities showing such a very uncommon form of abnormality.

When we sum up the lesson to be learned from the discovery at Halling, it falls under two heads. First, that at this early date the river-bed type of man was already in England. We have seen that Dr Schmerling had discovered this type in the Engis cave with the remains of extinct animals and the culture which characterises the Aurignacian age. The inference we draw from the discovery at Halling is that a human type may be transmitted over a long period of time and remain almost unchanged as regards size of brain and cranial characters.

But there is a much more important lesson to be learned, namely, that there probably still remain many untouched and undiscovered records of Palæolithic man in England, similar in nature to the hearths and skeleton discovered at Halling. Hitherto, we have sought for traces of Palæolithic man in caves; we hardly expected to read his history in the open country, in exposed valleys and in submerged land surfaces. Near Hastings, on the south coast of Sussex, not more than fifty miles from Halling, Mr Lewis Abbott discovered work-floors of Magdalenian date. Before the Halling discovery had been made, Mr J. Reid Moir had discovered and described a true Aurignacian floor, marked by hearths and characteristic flints, in a valley to the north of Ipswich, in Suffolk. Almost at the same time, Dr Allen Sturge discovered a similar floor in another part of Suffolk, near Mildenhall. More recently, Mr Reginald Smith, of the British Museum, has described a series of Aurignacian

floors found in England—all of them buried under sandy (loess) deposits.[1] We see, then, that it is possible that there may still be found under or near those ancient hearths remains of men who were living in England during the later phases of the glacial age. Within a year of his first discovery, Mr Reid Moir found another Palæolithic floor —in the excavations for the foundations of a house in one of the streets of Ipswich. The flints were of a more recent period than the Aurignacian, namely, the Magdalenian.

[1] See *Journ. Roy. Anthrop. Instit.*, vol. xliv., July 1914.

CHAPTER VII

FURTHER EXAMPLES OF LATER PALÆOLITHIC MEN IN ENGLAND

In our pursuit of Englishmen of the later Palæolithic phases of culture, we now pass to the very centre of England—to the eastern strip of the county of Derby which is crossed by the direct railway route from Mansfield, in the neighbouring county of Notts, to Sheffield, in the adjoining county of York to the north. Crags of magnesian limestone crop up in the eastern part of Derbyshire and streams pass eastwards to join the Trent. The eye of the passenger, as he journeys to Sheffield through this part of Derbyshire, is certain to catch the picturesque outlines of the Cresswell Crags, famous for their caves. Between 1873 and 1875, the Rev. J. Magens Mello [1] and Sir W. Boyd Dawkins explored the strata of those caves, and found, not only the remains of the various extinct animals which characterise the later Palæolithic periods, but also—the first discovered in England—one of those remarkable engravings on bone which give the cultures of the continental caves a high place in the estimation of artists. The carving found represents the head of a horse worked in the style of the cave men—probably of Magdalenian date. They also found flints worked in the same manner as the implements at Solutré. The discoveries at Cresswell Crags showed that the cultures of the late cave periods existed in England as well as France. The cave which is to give us the evidence

[1] *Quart. Journ. Geol. Soc.*, vols. xxxi. p. 679, xxxii. p. 240, xxxiii. p. 579, and xxxv. p. 724.

of which we are in search—the kind of man who lived in England during the Aurignacian period—is near a station short of the Cresswell Crags, three miles to the south of them, the station of Langwith. A little way to the east of the station lies the church and rectory of Langwith Bassett. Behind the clump of trees which surrounds the church and rectory runs a brook, the Poulter, flowing eastwards along a narrow valley. The rector, the Rev. E. H. Mullins, is an accomplished geologist. He had lived many years in the parish before he discovered that in the little valley, just behind the rectory, lay a buried cave rich in records of Palæolithic date. The discovery came about in this way. In the autumn of 1903 his son, Mr A. F. Mullins, then a Cambridge undergraduate, along with two college friends, was seeking a subterranean passage which tradition said existed between the valley and the church. They began to explore an old fox's earth which was hid amongst nettles and weeds on the side of the valley, just under a projecting outcrop of limestone rock and a little distance above the northern side of the stream—the Poulter. Forcing their way in on hands and knees, they discovered that the cavity widened and led, by spaces they could just squeeze their bodies through, to other passages and expansions. It was then that it dawned on Mr Mullins that they had discovered a buried or filled-up cave which might yield similar treasures to those revealed by the neighbouring caves in the Cresswell Crags years before.

The household of the rectory began a systematic and laborious exploration of the cave—extending over a number of years from 1903 onwards. The net result of their labours,[1] I have represented diagrammatically in fig. 45. It will be seen that the cave had become filled almost to the roof, the deposit on the floor amounting in depth to about 12 feet (3·6 m.). When the entrance and the first or central chamber (about 13 feet in diameter) were cleared, the original floor of the cave was

[1] See account by Mr Mullins, *Derbyshire Archæological and Natural History Society's Journal*, 1913, p. 1.

found to be about 8 feet above the stream which flows past the entrance—the level of the stream at this point being 300 feet above Ordnance datum. In the deposit which filled the cave, Mr Mullins recognised three horizons, the upper horizon fading into the middle, and the middle into the lower zone. The upper horizon, about 3 feet in depth, made up of loam similar to that forming the surface soil of neighbouring fields, yielded remains of modern small animals. The middle horizon, varying from 5 to 6 feet in depth, made up of the same

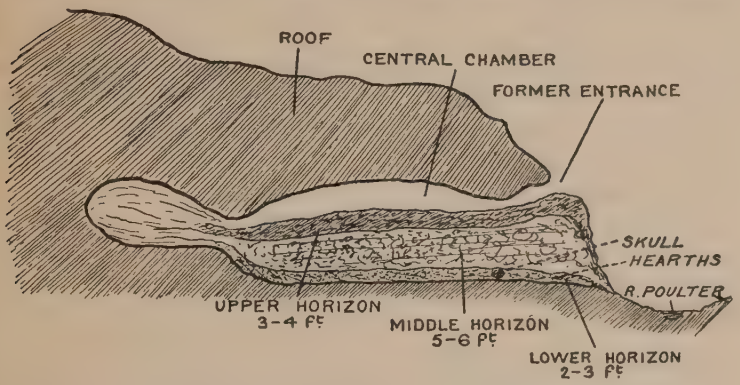

FIG. 45.—A diagrammatic section to show the horizons Mr Mullins recognised in the cave earth at Langwith.

material as the upper horizon, was studded with blocks and chips of limestone, often partially cemented together. No layer of stalagmite was seen either above or below the middle horizon. The middle stratum yielded abundant remains of extinct animals, such as characterise the later phases of Palæolithic culture. In this stratum, near the entrance, at a depth of 2 feet, was found the radius of a woolly rhinoceros; in the same stratum of the central chamber, the humerus of a cave-bear which had been gnawed by a cave-hyena. The lower or bottom stratum, made up of a sandy loam, and varying in thickness from 2 to 3 feet, yielded abundant evidence of man's occupation. As will be seen from fig. 45, the bottom layer of the central chamber extended through the

entrance towards the present bank of the stream. The remains of ancient hearths and floors occurred at all levels of the bottom stratum, in the central chamber, at the entrance, and on the old terrace in front of the entrance. Calcined stones, "pot-boilers," and numerous worked flints and a bone pin occurred at this horizon. So did the remains of extinct animals—the woolly rhinoceros, the cave-bear, brown bear, the reindeer, the urus (*Bos primigenius*), the lemming, the Arctic hare, and many other members of a fauna indicating a colder climate than the present. Mr Mullins had the advantage of expert advice from Mr E. T. Newton, Mr A. C. Hinton, and Mr A. S. Kennard in identifying the fauna yielded by the Langwith cave—a fauna represented by sixty different species. As to the flint implements there can be no doubt; they represent the culture of the Aurignacian, and probably also of the Magdalenian period. The remains of the extinct animals found with the flints and hearths in the bottom stratum are those which usually occur in cave deposits of the Aurignacian culture. There can, therefore, be no hesitation in regarding all that lay in the deepest stratum of the Langwith cave as belonging, not to our modern period, but to the Pleistocene epoch.

The following account of the discovery of the remains of the man himself, in the deepest stratum, is given in Mr Mullins' own words :—[1]

> "On the left-hand side of the entrance and 9 or 10 feet down, quite close to the floor, and also on the side wall of the cave, under what seemed to be a natural arch, formed by a fall of the roof in an early age (but there is no sign of any such fall in the present roof), we found the Langwith skull. There were no signs of other bones along with it, but it was clear that the skull could not have been interred in any historic time by man's agency. . . . How did the rock arch fall after the skull was there?

[1] Letter to the Author, 12th October 1909.

How did 9 to 10 feet of stone blocks, chips, Pleistocene bones, sand, clay, etc., completely fill up the space near this skull ? "

From what we have seen at Solutré, in the caves of Mentone and Engis, at Halling and at Paviland, we are not surprised to find a skull buried beneath or near the hearths of Aurignacian man. We also see the most likely explanation of the arch of stones over the skull ; it appears to represent part of the grave. At Paviland and in the Grimaldi caves, Aurignacian man protected the head of the dead by an arrangement of stones. But where is the rest of the skeleton ? Only the brain case of the skull remains—the face, the teeth, and the jaws are gone. Parts of the backbone were found—two vertebræ from the dorsal region ; some joints of the fingers were recovered in the neighbourhood, but not a trace of the long bones of the limbs. We have seen, however, that at certain periods hyenas frequented the cave, and their presence may explain the disturbed and dismembered skeleton. A fragment of the skull of a young child was also obtained in the bottom stratum.

For three reasons, I failed at first to recognise the importance of the discovery Mr Mullins had made. The skull he put into my hands gave us, for the first time, positive evidence as to the kind of man living in England during the period of Aurignacian culture. My reasons or prejudices fell under three heads. The skull seemed but a somewhat aberrant form of the specimen found in the old deposits of the Trent at Muskham—only thirty miles to the east of Langwith. The Trent skull is the standard example of the river-bed type. I then shared the prevalent belief that the river-bed type of skull was characteristic of the Neolithic period, and that when we passed into that indefinite hinterland of time, known as the Pleistocene and characterised by Palæolithic forms of culture, we should certainly find a very different type of man. Many animals of that time had become extinct ; it was probable that Palæolithic races of men shared their

fate. Hence I kept searching for evidence which would justify me in assigning the Langwith skull to the Neolithic period. In the second place, I failed to perceive how completely Mr Mullins had proved that the skull was contemporaneous with the deepest horizon and that the culture of that horizon was truly Palæolithic. My third prejudice related to the condition of the skull; it was brown in colour, dense and heavy, but so fresh in its composition that I could not think it to be really ancient. The following note (27th February 1911) from Mr Mullins will explain how my doubts on this head were removed. I made a careful examination, and also records of the skull, and returned it to the discoverer, expressing my doubts as to its antiquity. Mr Mullins sent the skull back to me accompanied by bones of the bison, cave-bear, woolly rhinoceros, reindeer, and a bone awl, with the accompanying information: "These are sent for Dr Keith to note their state of preservation. They all come from the same side of the cave and the same horizon, except the bone awl, which I believe came from the north-west passage of the cave—upper horizon."

I had, therefore, to abandon the belief that people with heads of the river-bed type did not transcend the Neolithic period. Langwith cave revealed the fact that this type goes far back into Palæolithic times. The type is infinitely older than we had originally supposed. The discovery made by Dr Schmerling revealed this river-bed type in a cave of Aurignacian date in Belgium. The discovery at Halling was not made until 1912. At Paviland, the skull of the Aurignacian skeleton was not found. Here, then, we have the most positive evidence of the persistence of certain human types. Skulls of the Langwith type are still quite common among the English people of to-day; they were also in evidence in England of the Aurignacian period, some seventeen thousand years ago or more.

The characters of the skull do not require minute description. In fig. 46, the skull is set in the conventional frame of lines and viewed from the side and the front.

In fig. 47, it is represented from above and compared with the Trent (Neolithic) skull. The brain capacity is

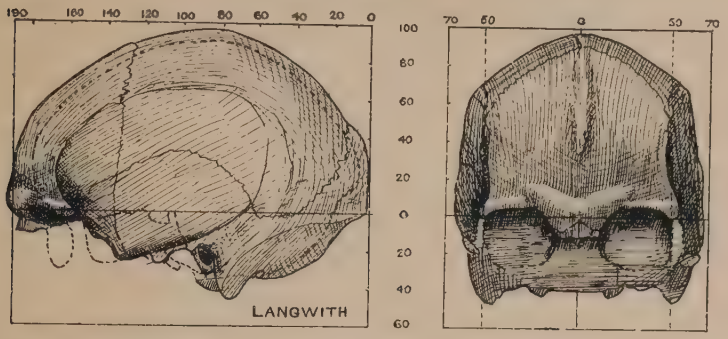

FIG. 46.—The Langwith skull viewed from the side and from the front.

low; when measured by filling the cavity of the skull with millet seed, the size of the brain is found to be only

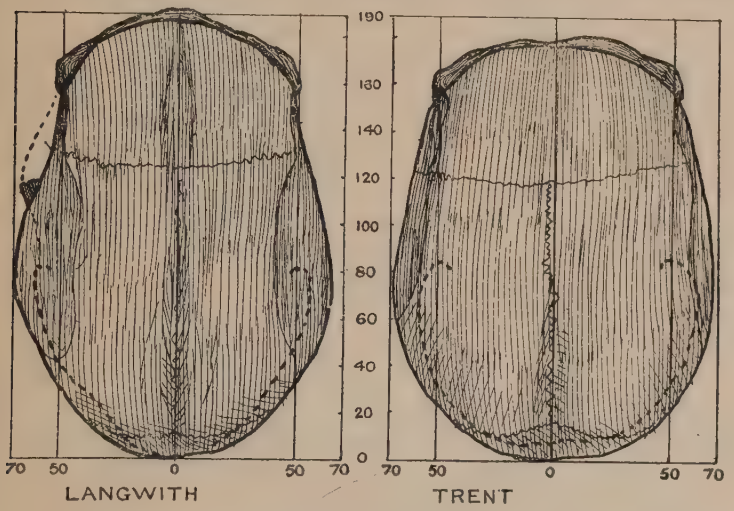

FIG. 47.—The upper aspect of the Langwith skull contrasted with the Trent skull of Neolithic date.

1250 c.c.—about 230 c.c. under the modern average. In this respect it differs from most skulls of the Palæolithic period, which are commonly above the modern standard. But, if small, the skull shows no

feature which we can call low or primitive, except that, as is so often the case in the skulls of Australian natives, the brain chamber gives one the impression of being imperfectly filled—the sides are flat, approximate as they ascend, and the vault rises almost to a keel. Nevertheless, it is a strongly modelled skull, of a man aged between forty and fifty years—so we infer from the partly closed condition of the sutures between the several bones of the vault. Very probably the man was of small stature and of slight make, as is usually the case in races with the river-bed type of skull. The maximum length of the skull is 192 mm., 180 mm. of that measurement being due to length of brain, the rest to thickness of bone in the frontal and occipital walls. The maximum width, just above and behind the ear-holes, is 135 mm., the width being 70 per cent. of the length—a narrow skull. The height of the vault above the ear-holes, 113 mm.—a small amount, especially when one remembers the bone along the vault is much thicker (9 mm.) than in most modern skulls (5–6 mm.). Another measurement indicating the total height of the skull (basi-bregmatic) is 127 mm.—also a low amount. The distance between the orbits—at the root of the nose—is, as in modern British skulls, 24 mm. The eyebrow ridges are pronounced, the frontal air sinuses large. The difference between the minimum width of the forehead (95 mm.) and the maximum width (110 mm.), which is measured between the extremities of the supra-orbital ridges, is considerable (15 mm.), certainly a primitive character. The temporal muscles of mastication are rather larger than usual. At least the lines which mark the upper limit of the attachment of those muscles are placed, as is often the case in small modern skulls, unusually far above the zygomatic or cheek arches. In the Langwith skull these lines are situated 100 mm. above the zygomatic arches, and only 48 mm. from the middle line along the roof of the skull. As is usual in this type of skull, the occiput projects backwards as a boss or cap. The area differentiated for the attachment of the neck is of moderate dimensions, and the width of

the neck behind the ears, the bimastoid width, is 120 mm. The width of the face (bizygomatic diameter) was about 130 mm. It is a small-headed man we have to picture in the Langwith cave, but one not showing any markedly low or primitive character.

To continue our survey of the remains of late Palæolithic man in England, we now move from the centre to the south-west of England—to that part of the county of Somerset which bounds the eastern shore of the Bristol

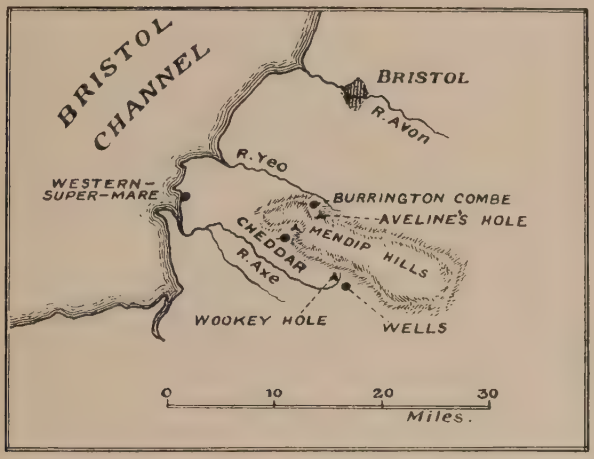

FIG. 48.—A sketch map of the Mendips, showing the position of Wookey Hole, Cheddar Cave, Burrington Combe, and Aveline's Hole.

Channel. Here a range of carboniferous limestone hills —the Mendips—run from east to west (fig. 48). Along their southern base flows the Axe, making a westward course through a marshy, flat strip of country. Near the cathedral town of Wells, only sixteen miles distant from the Bristol Channel, the Axe issues from a cave in a southern cliff of the Mendips. Close by is the famous hyena cave—Wookey Hole—first explored by Sir William Boyd Dawkins in 1859, the year before Lartet examined the cave at Aurignac. In that year, and in the following, he discovered in the buried floor of the cave the hearths, the flints, the bone implements, and the

extinct animals which Lartet found in the cave at Aurignac —only more abundantly; he found no human remains. Sir William arrived at the same conclusion as Lartet, namely, that man must have existed as a contemporary of the extinct Pleistocene animals. The veteran pioneer of "Cave Hunting"[1] has lived to see a revolution in our attitude towards the question of man's antiquity. A passage he wrote in 1860 will show that the truth he contended for then is now admitted by all. "It is certain that man was contemporary in the district with the hyena and the animals on which it preyed, and the fact that the ancient implements were found only on one spot implies that they were deposited by the hand of man. To suppose that a savage would take the trouble to excavate a trench 24 feet long with miserable implements and consequently with great labour, and, having excavated it, again to fill it up to the very roof, is little less than absurd." With every word of which, I am sure, the reader will agree. Nor will he more easily believe that Neolithic man would take the labour to cut through the thick stalagmitic floors of such caves to bury his dead in a stratum with extinct animals and Palæolithic flints, and take pains to cover up the date of his deed in order to deceive his cave-hunting descendants.

No human remains were found at Wookey Hole. To reach the cave which disclosed the remains of Palæolithic man himself, we have to follow the Axe along the southern foot of the Mendips, until it guides us to the village of Cheddar, half-way between Wells and the coast (fig. 48). The caves at Cheddar have been famous for a long time, and, with the museum attached to them, form a popular resort for summer visitors. The proprietor, Mr R. C. Gough, began the excavation of a "new" cave in 1892. In the débris at the entrance were found, as at Wookey Hole, traces of all the cultures which succeeded the Neolithic period. The floor of the cave had the usual structure—a superficial stratum of recent deposit

[1] *Cave Hunting*, Macmillan & Co., 1874.

2 to 4 feet thick. Then followed a layer of stalagmite, 5 to 12 inches (10 to 25 cm.) thick (fig. 49). Beneath the stalagmite lay a stratum of red cave earth, 6 to 8 feet in depth, containing abundant remains of extinct Pleistocene animals. There were also found the hearths, the flint and bone work of, not the Aurignacian, but—as Mr H. N. Davies was the first to recognise—a later Palæolithic period, the Magdalenian, the culture found in its representative form in the station of La Madeleine in the ravine of the lower Vézère, France.

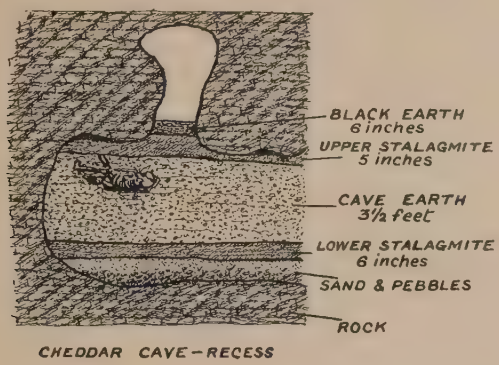

FIG. 49.—Section of the strata in the recess of the cave in which the Cheddar skeleton was found.

In December 1903, Mr Gough, to secure better drainage for the central chamber of the cave, began to open up a side recess or fissure. It was filled with the usual red cave earth and capped by a layer of stalagmite. Under the stalagmite, and embedded in the cave earth to a depth of 1½ feet (0·450 m.), he exposed a human skeleton, lying back down, and the thighs partly drawn upwards, as if it had been placed in the partially contracted posture (fig. 49). The skeleton was seen and examined by Mr H. N. Davies, and all the facts relating to the discovery were collected and placed on record by him.[1] Subsequently, these remains were more fully

[1] H. N. Davies, *Quart. Journ. Geol. Soc.*, 1904, vol. lx. p. 335.

examined by Professor Parsons.[1] In all its characters, the skull falls into the river-bed group. Its length is 196 mm.; its width, 138 mm., is 70·4 per cent of the length; the height of the bregma above the ear passages is 115 mm., but the highest point of the vault rises to 122 mm. The brain capacity is estimated to be approximately 1450 c.c. It is thus 200 c.c. larger than the Langwith skull, and resembles that specimen in several of its features, but is less primitive, the brain bulging its sides and giving a steep contour to the forehead. The vault in both is 9 mm. thick. The face, however, is preserved in the Cheddar specimen, but it shows no exceptional feature. The thigh bone is 435 mm. long, from which we infer that the Cheddar man was of low stature—about 1620 mm. (5 feet 4 inches). The leg bone (tibia) shows the side-to-side flattening seen in Neolithic races—less commonly in races of Palæolithic date. Thus we see, so far as the evidence will take us at present, that a people with the river-bed type of head inhabited England from the Aurignacian period onwards.

The Cheddar cave lies in a gorge on the southern flanks of the Mendips. On the opposite or northern side, little more than three miles distant, a ravine or combe, known as Burrington Combe, cuts into the strata of mountain limestone (fig. 48). This combe, as recent discoveries have proved, was also a haunt of Palæolithic man. The traveller on entering the mouth or north end of the combe, and following the road which leads upwards, along its bottom, has on his left a steep, grey, seamed limestone cliff, which ascends 150 feet above him. A little way along this road the arched mouth of Aveline's Hole is seen to open at the foot of the cliff. The mouth, although a little below the level of the roadway, and, therefore, subject to flooding, is almost 300 feet above the level of

[1] *Reports of Seventeenth Internat. Med. Congress*, 1914, Section I., Part II., p. 91. Professors C. G. Seligman and F. G. Parsons contributed a paper on the Cheddar man and his civilisation which appeared in the *Journ. Roy. Anthrop. Instit.*, 1914, vol. xliv. p. 241. The measurements in the text are those given by Professor Parsons.

the Bristol Channel, fully ten miles to the west. The opening leads into a spacious cave which strikes inwards for a distance of 130 feet, and also sinks a little as it goes; its vaulted roof is 10 feet high; but it is narrow—only about 12 feet wide. In the floor we find, just as at Cheddar, an upper stalagmitic stratum, about a foot in thickness, and under this hard and resistant crust, 3 or 4 feet of red cave earth. It was in this red cave earth and in the stalagmitic stratum over it, at a distance of 75 feet

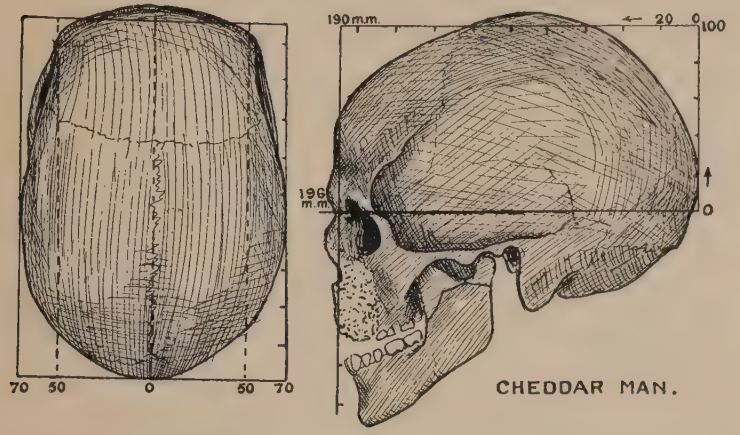

FIG. 50.—Profile and vertex of the skull of the Cheddar man. Oriented on the sub-cerebral plane. Stalagmitic material still covers the maxillary part of the face.

from the entrance, that there was made a very important discovery of early inhabitants of England.

As in the case of the famous French cave at Aurignac, the discovery of Aveline's Hole was the result of a happy accident. Towards the close of the eighteenth century two youths were chasing a rabbit in Burrington Combe when it escaped into a hole at the foot of the cliffs. They dug into the burrow and found themselves at the mouth of a cave—now known as Aveline's Hole. When the rubble wall at the entrance was broken down the cave was found to contain skulls and bones of some fifty people; for this cave, like that at Aurignac, had been used as a burial place by the people who lived in the district during

the Neolithic period. The skulls and skeletons disappeared, and the cave fell into neglect, until quite recently, when the University of Bristol in the flush of its youth took the cave under its charge. Just before the war, led by their Professor of Anatomy, Dr Edward Fawcett, the students of this University formed a Society for the exploration of neighbouring caves, and in 1914 commenced work in the floor of Aveline's Hole.[1] After the war they returned, and by 1922 were in the position to supply a page or two for a chapter which deals with the period of the Transitional or Azilian culture, when the old Stone age was coming to an end and when temperate conditions were shifting the ice-sheet in its final retreat to the north. In the cave earth were found double-barbed harpoons worked from the antlers of the stag, and small and finely worked flints belonging to that Palæolithic culture named Tardenoisian, after Fère-en-Tardenois, a village on the Ourcq, twenty-five miles to the west of Rheims (fig. 37, p. 105). There were remains of a large-antlered stag, of the reindeer, brown bear, lemming, and of other animals belonging to the closing phase of the Pleistocene period. On the moderate chronological scale followed in this work, Palæolithic man was living in Aveline's Hole and hunting his game among the combes of the Mendips somewhere between 8000 and 10,000 B.C.

What sort of men were they? Parts of eleven individuals—of children as well as of adults—were found, but only three skulls are sufficiently complete to give a sure indication of the form and size of head. One of them, skull "A," represented in fig. 51, was embedded in the upper stratum of stalagmite. Its dimensions, it will be observed, are very similar to those of the Cheddar

[1] A full account of the exploration of this Society—the Speleological Society of the University of Bristol—will be found in its published *Proceedings*, vol. i. No. 1, 1919–1920; No. 2, 1920–1921; No. 3, 1921–1922; No. 4, 1923–1924. A full account of the Archæology of the cave will be found in No. 3, by Mr J. A. Davies, who regards the culture of Aveline's Hole as Aurignacian, and of the Human Remains in Nos. 1, 2, and 4, by Professor E. Fawcett and Sir A. Keith.

skull. Both are a little longer, a little narrower, and a little higher than the form of skull now prevalent in England, but is it not remarkable that we should find at so early a date a form of skull which approximates so closely to the British type? Skull "A" has a length of 192 mm., a width of 138 mm.; the width is 72 per cent. of the length; the vault rises 116 mm. above the ear passages; its capacity is 1450 c.c., slightly under the modern average. Neither this skull nor the two others

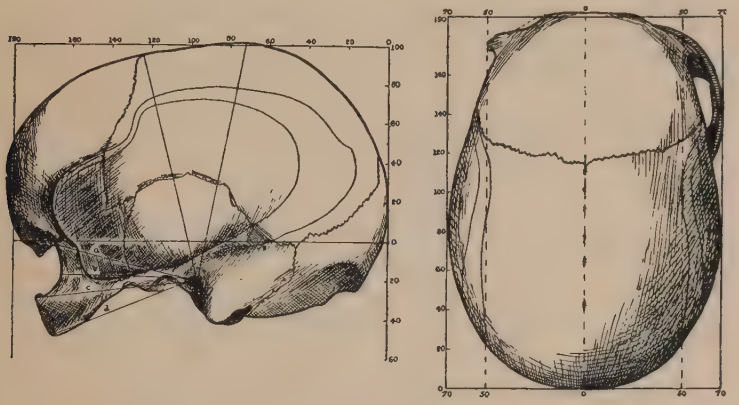

FIG. 51.—Profile and vertex of skull "A," from Aveline's Hole. The profile is represented on the sub-cerebral plane; the vertex on the Frankfort plane.

are thick-walled; along the roof the thickness varies from 6 to 8 mm. Unfortunately the face, which is so valuable in guiding us in our search for racial affinities, is here almost completely missing. Only the cheek bone and the zygomatic arch of one side are present. The cheek bones were prominent, high, and welled forwards on the face. The zygomatic arches, on the sides of the face, were strong and well apart; the bizygomatic width was at least 140 mm.—10 mm. more than is usual amongst modern Englishmen. It will be noticed, too, how prominent is the upper part of the forehead; it recedes as it descends to the mildly developed supra-orbital ridges. There are none of the robust features which mark the

skulls of men belonging to a primitive type. The sexual characters are not well marked, but, taking all the features into consideration, I am of opinion that it is the skull of a man who at the time of death was in his fifth or sixth decade.

Skulls " B " and " C " from Aveline's Hole, imperfect although they be, are particularly worthy of close study. We have seen that in the skulls of the Aurignacian period which were discovered at Solutré (p. 92) the width represented almost 80 per cent. of their length. At Ofnet, in a stratum of the same age as that represented

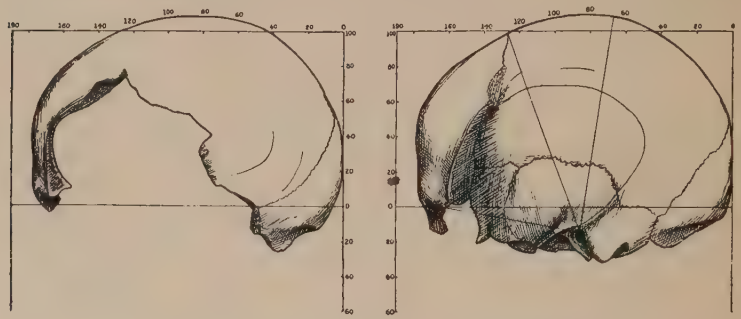

FIG. 52.—Profiles of skulls " B " and " C " from Aveline's Hole, oriented on the sub-cerebral plane.

at Aveline's Hole, we found people who were distinctly round-headed mixed with others who had long heads; there were some, too, of an intermediate shape. Thus we see that the wave of round-headedness, or brachycephalism, which was ultimately to impress itself on the greater part of the population of Europe, and which, apparently, commenced in the East, was making its way across the Continent in Palæolithic times. We had no reason to believe that it reached Britain at this early date. The discovery of Aveline's Hole, however, now assures us that this Palæolithic wave also reached the west of England, for skulls " B " and " C " have a breadth index of 80. These two skulls, imperfect in base and face, have almost the same length, 178 mm.; they are short skulls, and their width is only moderate—142 mm., as near as one

may judge. One of them, " B," has the female markings ; the other, " C," those of the male. In both, the vaults of the skull are particularly lofty, as if the brain had expanded more than usual in an upward direction, thus increasing the height of the skull at the expense of its length. In " C," the vault rises 124 mm. above the ear passages ; in both, it rises 108 mm. above the sub-cerebral plane. Round-headedness occurs in several forms, and when we search for the kind met with in these two skulls from Aveline's Hole, it is to the type found at Solutré and to the modified variety which is represented by the Chancelade skull (p. 83) that we can trace the nearest affinity. It must not be thought that because skull " A " has a head width of 72 per cent., while the width in " B " and " C " is 80 per cent., that two different races of mankind are represented in Aveline's Hole. A close comparison of their various features shows that all three may very well have been members of the same blood-community. Only in " B " and " C " some foreign element or strain has become manifest. We should remember that the introduction of a small leaven of a " dominant " character, such as is represented by round-headedness, may lead to this feature becoming disseminated throughout a long-headed community, and yet the blood of the original community be diluted to only a slight extent. The discovery in Aveline's Hole shows us that England was not isolated in late Palæolithic times. New blood reached her from the Continent ; new fashions in culture and manners of living arrived, and replaced old cultures and former customs. At the same time wild animals from the Continent also came to make a home in England as her climate changed.

In our search for the remains of cave man in England we pass from the Mendips and Somerset to the shores of Torbay, situated on the south coast of the neighbouring county of Devon. The bay, one of the most beautiful in England, is bounded by two headlands or horns, about five miles apart. Amongst the green terraced hills of Devonian limestone, which form the northern headland,

is situated Torquay, with Kent's Cavern hid in a valley in the suburbs of the town; on the southern headland is the busy fishing town of Brixham. In 1858, Mr Philip of this town was preparing to build on the limestone hill above the harbour, when his workmen opened an unknown natural subterranean passage or cavern—some 600 feet in length—from then onwards known as the Brixham cave.

In 1858, the question as to whether man did, or did not, exist with extinct animals was being hotly debated. One of the leading geologists of the time, Dr Hugh Falconer, induced two of the premier London Societies — the Royal and the Geological —to explore the cave and settle the question. A pioneer in cave exploration, Mr William Pengelly,[1] undertook to direct the work and record the results. In fig. 53, I reproduce a copy of his section across the cave to show the strata of the floor. They correspond with those just seen in the caves of the Mendips. There was a bottom stratum of gravel; a middle stratum of 5 to 6 feet in thickness of red cave earth, which contained bones of the woolly rhinoceros, mammoth, hyena, lion, bear, etc. Then over the cave earth came a stratum of stalagmite about a foot in thickness, in which an antler of the reindeer was embedded; over the stalagmite was a surface stratum of recently-formed earth. In the cave earth, mingled with the bones of the extinct animals, were found flint tools shaped by man. The exploration thus settled the question as to man's contemporaneity

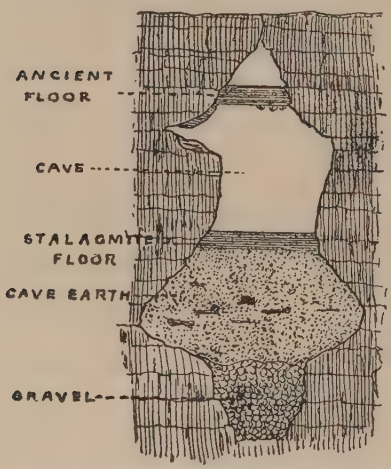

FIG. 53.—Section across the Brixham cave showing the strata of the floor. At some former period the cave had been filled to the height of the "ancient floor."

[1] See reference, p. 145.

with extinct animals, but threw no light on the kind of man or the place of his culture in the scheme of human evolution.

To obtain light on those problems, we must pay the great neighbouring cave—Kent's Cavern—a cursory visit. In 1846, the Torquay Natural History Society, of which William Pengelly was the moving spirit, began to explore this vast series of damp, dark passages, vaults, chambers, and subterranean corridors. The task was one beyond its means. In 1864, Pengelly induced the British Association to take up its exploration. From 1864 to 1880 nearly £2000 was spent on the work, and although 50,000 fossil specimens were excavated, cleaned, identified and labelled, the Herculean task of exploring Kent's Cavern is little more than begun.[1] The upper strata of the floor are the same as at Brixham—a surface earth containing traces of all cultures from Neolithic down to the present.[2] Below the superficial débris came (fig. 54) : (1) the upper stalagmite, in some places 3 feet thick ; then (2) the red cave earth, 3 to 5 feet thick, with bones of extinct animals and implements of the later Palæolithic periods, Aurignacian and Magdalenian. In strata 1 and 2, remains of the woolly rhinoceros and of the mammoth were abundant, indicating that these layers were deposited during a period of great cold. Beneath the cave earth began a second and older series of deposits, commencing with (3) the lower stratum of stalagmite, covering (4) a great depth of breccia, composed of chips of sandstone and slate firmly cemented together. The lower or older deposits contain evidences of early human cultures which do not concern us at present, but show us that in this cavern—

[1] See a Memoir on William Pengelly, F.R.S., by his daughter, Mrs Forbes Julian, London, 1897.

[2] I am much indebted to the late Mr Arthur R. Hunt and other members of the Torquay Natural History Society for information regarding the exploration of Kent's Cavern, and for opportunities of seeing the collections in their museum. See Mr Hunt's papers on Kent's Cavern in *Geological Mag.*, 1902, vol. ix. p. 114 ; *Proc. of Geologists' Assoc.*, 1900, vol. xvi. p. 425 ; *Journ. Torquay Nat. Hist. Soc.*, 1914, vol. i. p. 267. Also *A Short Account of Kent's Cavern*, Torquay, 1898.

the Stonehenge of the caves of Europe—man's history is carried an incredibly long way into the distant past.

The upper strata, however, have a direct interest for us because they belong to the time of the later phases of Palæolithic culture. In the upper stalagmite, and in the

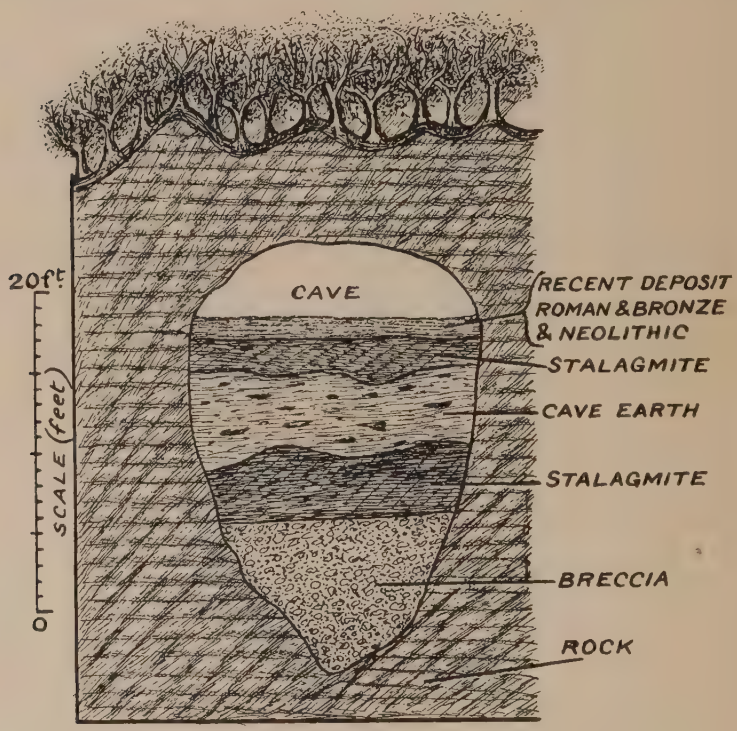

Fig. 54.—A diagrammatic section of the strata in the floor of Kent's Cavern.

upper layer of cave earth, just under the stalagmite, were found implements in bone and stone worked in the last Palæolithic phase—the Magdalenian—the same culture as characterised the cave at Cheddar. In 1867, Mr Pengelly found the right half of a human palate, with four teeth still in place, at a depth of 20 inches (0·500 m.) in the upper stalagmite. The palate lay unnoticed in its museum case at Torquay until 1912, when my friend, Dr W. L. H.

Duckworth, rescued it from oblivion.[1] In fig. 55 I give a drawing of this specimen—the right half of a palate. Side by side I have set the left half of a palate from a famous French skull of Aurignacian date, that found at Combe Capelle.[2] In shape and size, these two halves are very similar. The teeth, too, agree in dimension, shape, and character. In the adjoining drawing in fig. 55 I have represented the left half of the palate of a modern English skull, and the right half of the palate of a member of an

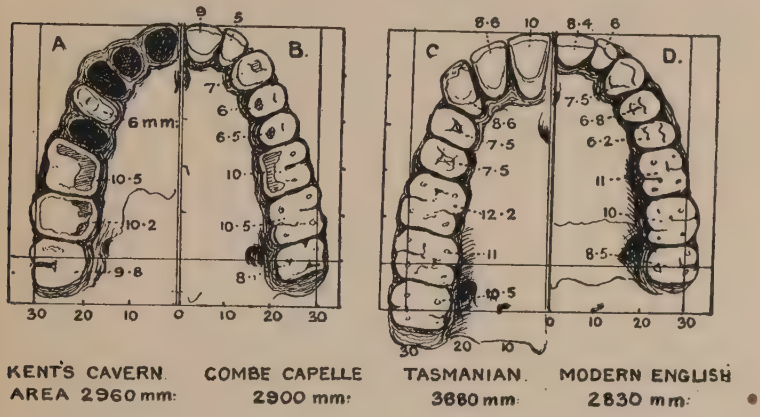

FIG 55.—A. Right half of palate from Kent's Cavern.
B. Left ,, ,, Combe Capelle.
C. Right ,, ,, Tasmanian.
D. Left ,, ,, modern Englishman.

extinct primitive race—the Tasmanian. The area of a well-developed palate of a modern Englishman is about 2800 mm.,[3] the area being the space bounded by the outer margins of the crowns of the teeth. The hinder border of the area is demarcated by a line joining the posterior margin of the last or third molar teeth (see p. 102). The particular Tasmanian palate represented

[1] See *Journ. Torquay Nat. Hist. Soc.*, 1913. See also *Brit. Assoc. Reps.*, Dundee, 1912.

[2] See p. 165.

[3] Later investigations have shown me that the estimate given here for the size of the "dental" palate of the average Englishman is too high; it is approximately 2500 mm.

in fig. 55 has an area of 3680 mm., 1200 mm. more than in the English palate. In the case of the two palates of Palæolithic man represented in fig. 55, the palatal area is only about 100 mm. above the average modern Englishman. The palate and teeth from Kent's Cavern do show a degree of robust development which is uncommon in modern mouths, but there is no character present which suggests that a strange or unknown race is represented.

The back-front diameters of the teeth are also given on the drawings. Measured along the line of the arch of the teeth, the three molars of the Kent's Cavern palate have a combined length of 30·5 mm., which, although above the average of our modern molars, is yet rather below that of primitive native races such as Australians or Africans (see dimensions on fig. 55). The cusps are worn off the chewing surfaces of the first and second teeth ; they had each four cusps—the full number—but the fourth cusp is absent from the last molar. The roots of the teeth are long and well separated, and, in my opinion—but here I differ somewhat from Dr Duckworth —show no trace of those features which characterise that peculiar and ancient Palæolithic race—Neanderthal man.[1] Mr George Jackson has shown me similar teeth and palates from caves opened near Plymouth. Thus, at Kent's Cavern, we have evidence of a closing phase of the Palæolithic culture, and just enough of one of the men of the time to show that he was not different from those found in other English caves.

To complete our survey of late Palæolithic man in Britain, we must continue our tour by passing eastwards along the south coast of England to the summit of the South Downs in the county of Sussex. The remarkable earthworks or camps on the top of the Downs at Cissbury, near Worthing, belong to the Neolithic period ; but the circular pits and depressions, about fifty in number, which occupy the same site, have yielded a peculiar culture, at first supposed to belong to an early part of the Neolithic period. In 1868, General Pitt Rivers began an investiga-

[1] See p. 210.

tion of those pits; the result of his explorations, and of others of a later date, was to show that the pits were in reality filled-in mouths of vertical shafts which went down 30 to 40 feet in the chalk. The significance of these shafts or mines was also clear; they were sunk to obtain the kind of flint most suitable for working into implements. They were flint mines. The veins of suitable flints were followed by driving horizontal galleries from the vertical shaft. The miners left tools behind them—now preserved in the filled-up mines. It has been customary to regard the culture of the Cissbury miners as representative of the dawn of the Neolithic civilisation. Subsequently, Mr Reginald Smith, of the British Museum, again examined the Cissbury culture, and the objects of the same period obtained from Grimes Graves, near Brandon, in Norfolk, and, in the light of what is now known of the cave men of the Aurignacian period, has come to the conclusion that the Cissbury miners were not a Neolithic, but a Palæolithic people. The evidence [1] he has produced is such that most students will now agree with Mr Smith that the flint implements probably belong to the period of the Aurignacian culture —the period of Cromagnon, of Grimaldi, and of Halling. Remains of the reindeer, of the mammoth, and of the rhinoceros occur in the caves of that period of culture; not a trace of them has been found at Cissbury. The ancient ox or urus (*Bos primigenius*), however, occurs. We scarcely expect the fauna of the period to be fully represented in mines. In Belgium, similar ancient flint mines occur. The Belgian miner—as may be seen in the Royal Natural History Museum of Brussels—was a short-headed or brachycephalic man, quite different from all Aurignacian races; his civilisation was not Aurignacian, but that of the Neolithic period. The miners at Cissbury, on the other hand, had heads of the river-bed type. In the buried shafts at Cissbury, the skeletons of two individuals were found and described by Professor Rolleston. One is the skeleton of a man under 5 feet (1·500 m.) in

[1] See *Archæologia*, 1912, ser. 2, vol. xiii. p. 109.

height, and showing a left-sided palsy, contracted in boyhood.[1] The length of the skull is 184 mm., width 132 mm., the width index being 71. He had the small brain capacity of 1350 c.c., and was buried in the contracted posture with his grave protected by blocks of chalk. The other skeleton [2] was that of a woman with a very large head (length 195 mm., width 144 mm., the width index being 74). The brain capacity was estimated by Professor Rolleston to be 1732 c.c.—a great amount, particularly in a short woman with a stature of only 5 feet.

The question raised by Mr Reginald Smith concerning the Palæolithic culture of these ancient mining folk makes it necessary for us, before bringing this chapter to an end, to pay a hurried visit to the southern boundary of the county of Norfolk, where the Brandon or Little Ouse carries its sluggish waters westwards to join the parent river—the Great Ouse. In the village of Brandon flint-knappers still ply their ancient trade. Three miles along the road which leads from Brandon to Norwich we reach a plantation, some 20 acres in extent. Stunted trees struggle for an existence in the midst of bleak surroundings. On the site of this plantation the remote ancestors of the Brandon flint-knappers carried on an enormous industry over a long period of time. The chalk, which contains the veins of flints, is here covered by strata of sand and boulder clay some 8 feet in depth ; the Neolithic miners sank shafts and pits through the superficial strata and dug into the chalk to a depth of 27 feet or more, undermining and running side galleries to follow up the best veins of flints, which lay at the bottom of their pits. Some of the pits were of great size, the openings of some of them having a diameter of 40 feet. In the plantation there can still be counted the hollows and mounds belonging to 366 of these ancient flint mines. When the supply of flints became exhausted in a pit, it was partly filled in, and used as a shelter or habitation by the families of the early miners. Hence it is that the excavation of these

[1] See Rolleston, *Journ. Anthrop. Instit.*, 1878, vol. viii. p. 377.
[2] *Ibid.*, 1876, vol. vi. p. 20.

pits—known as Grimes Graves—has brought to light many relics of the miners, and has thrown a flood of light on one of England's earliest industries.

In 1914 members of the Prehistoric Society of East Anglia commenced a systematic exploration of the area covered by Grimes Graves. They found clear evidence of three periods of occupation: (1) of the Bronze age; (2) of the Neolithic age; and (3) of an older age, possibly Palæolithic, for flint nodules engraved in the style of the late Palæolithic hunters of France were found, and, as at Cissbury, implements worked in Palæolithic fashions, some of them exactly in the manner adopted by the cave-dwellers of Le Moustier in mid-Pleistocene times.[1]

Thus the committee which investigated Grimes Graves found that the locality had been mined for flint at various periods of time, the earliest being when Palæolithic implements were in use. It also discovered parts of the actual miners; in Pit 1 the vault of a man's skull was found; in another pit the scattered remains of the skeleton of a young girl. The man's skull was found in the fifth layer of Pit 1, 10 feet 8 inches below the original surface of the ground. Although this skull belongs to the Neolithic horizon it is worth careful scrutiny, because of the older culture which precedes the Neolithic and also is intermingled with it. The skull is long—192 mm.; its width, 145 mm., is 75·5 per cent. of its length (fig. 56). The vault, although of more than average height, being 117 mm. above the ear passages, appears low because of the flatness of the crown of the head and the width apart of its sides. The supra-orbital ridges were strongly developed and the bones along the vault reached a thickness of 8 mm. The forehead was wide—100 mm.—and the

[1] *Report on the Excavations at Grimes Graves, Weeting, Norfolk*, by Dr A. E. Peake and others, edited by Mr W. G. Clarke, and issued by the Prehistoric Society of East Anglia, 1915. *Report on Human Remains*, by A. Keith, p. 134. See also further Reports by Dr A. E. Peake, *Proc. Prehist. Soc. East Anglia*, 1917, vol. ii. p. 409; 1919, vol. iii. p. 73. "Note on the Fauna," by W. G. Clarke, 1921, vol. iii. p. 431. "Reports on Engraved Stones and Ancient Floors," by Mr A. Leslie Armstrong, 1922, vol. iii. pp. 434, 548; 1924, vol. iv. p. 113.

cranial capacity, 1530 c.c., was well above the modern average. The cranial type conforms exactly to that found at Cissbury, and differs somewhat from the Palæolithic type found at Cheddar, in being wider and having a flatter dome. Still, we must regard the Grimes Graves and Cheddar skulls as being merely variants of the same long-headed type of man.

How are we to explain the occurrence of flint implements worked in the style of Le Moustier in these ancient mines? Did Englishmen actually work flint mines at so early a period as that represented by the Mousterian

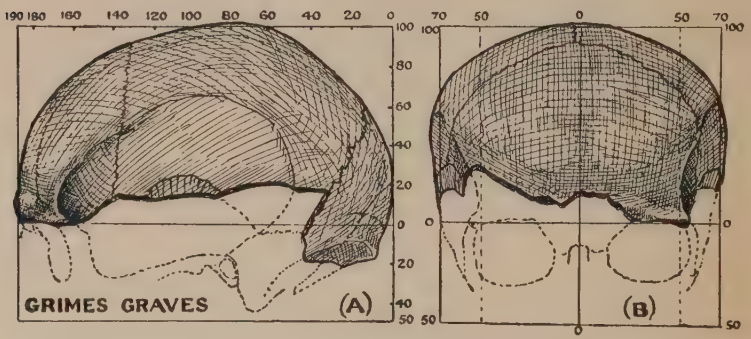

FIG. 56.—Profile and full face of the cranial vault of a man's skull found in Pit 1, Grimes Graves.

culture in France—a culture which is believed to have come to an end some twenty thousand years ago, or more? Or was it that the ancient miners at Brandon and at Cissbury were conservative in their habits, and even when the wave of the earliest Neolithic culture was spreading over England, they still practised an art which came down to them traditionally from Mousterian times? The latter must, I think, be the true explanation, for neither at Cissbury nor at Grimes Graves were found the fossil remains of those animals which are known to have flourished with the Mousterian culture.

Further evidence of this contention will be found, I think, if we call at Ipswich on our way back to London, where this chapter is to be brought to an end. At Ipswich

the great plateau of Suffolk, capped with chalky boulder clay, sinks rapidly from a height of 160 feet O.D. to the bottom of the valley of the Gipping. The town rises from the railway station, situated in the valley, to the shoulders of the plateau, having a fine aspect to the south and west. On the western shoulder of the plateau, to the north of Ipswich, is a shallow side valley, which Mr Reid Moir has made known to all students of ancient man. By carefully conducted excavations through deposits which had accumulated on one side of this valley, Mr Reid Moir exposed two horizons or floors which had been occupied by ancient man.[1] In the upper floor was found clear evidence of an Aurignacian culture; on the lower and older level, equally definite evidence of a Mousterian culture. In the lower level, too, fragmentary bones of man were discovered, but these undoubtedly belonged to the type of man found at Grimes Graves and at Cissbury. In these ancient floors, as at Grimes Graves, the fauna characteristic of the Aurignacian and Mousterian periods was most meagrely represented. May not these discoveries be construed as evidence in support of conservative tendencies on the part of our remote ancestors?

To bring this chapter to a close, we shall return to the very centre of London, to the Horse Guards on the north bank of the Thames between Trafalgar Square and Westminster. The land here holds the same relationship to the Thames as the Halling terrace—at which we started—bears to the Medway. In 1892, foundations were excavated in this area for a new Admiralty building, exposing a section of the north bank, or low terrace of the Thames, which was carefully studied and recorded by Mr Lewis Abbott.[2] Eleven feet below high-tide level was found an old land surface, bearing in an "Arctic bed" remains of plants which are natives of a cold climate. That bed marks the closing phase of the glacial period,

[1] Mr J. Reid Moir, "Two Ancient Occupation Levels," *Journ. Roy. Anthrop. Instit.*, 1917, vol. lvii. p. 367.

[2] *Proc. Geol. Assoc.*, 1892, vol. xii. p. 346. See also *Proc. Prehist. Soc. East Anglia*, 1919, vol. iii. p. 110.

evidently corresponding with the date of the formation of the lowest terraces of the Thames and Medway valley. Mr Hazzeldine Warren [1] has described an extensive and apparently contemporaneous Arctic bed in the valley of the Lea, in the east of London. Over the Arctic bed in the foundation of the Admiralty building, Mr Abbott found a deep bed of gravel, containing remains of Pleistocene mammals and also a flint implement typical of the Solutrean culture—the culture following the Aurignacian, but preceding the Magdalenian. We have seen that in the cave at Langwith, with the evidence of an Aurignacian and of a Magdalenian culture, animals of a sub-Arctic climate were present. We are therefore justified in concluding that towards the close of the Palæolithic period the climatic conditions were much colder than now. We are uncertain as to the causes of climatic change, but we cannot believe, from our knowledge of historic times, that such changes can be brought about except by imperceptible degrees extending over a long period of time. Yet, long as is the period which has elapsed since Arctic conditions last ceased, the type of man represented in the caves of Derbyshire and Somerset has persisted, with his body altered only in minor details.

[1] *Quart. Journ. Geol.*, 1912, vol. lxviii. p. 213; 1916, vol. lxxi. p. 164.

CHAPTER VIII

THE MOUSTERIAN PERIOD IN ENGLAND AND THE MEN OF THAT PERIOD IN FRANCE

In this chapter we are to take another great step backwards into the past. The period of Neolithic man lies far behind us; in the two preceding chapters we have made a cursory survey of the men of the late Palæolithic cultures, and formed, on the limited evidence at our disposal, some estimate of their antiquity. As nearly as we can guess at present, the point in time which marks the beginning of the late Palæolithic age and the close of the one preceding it—the middle Palæolithic—lies about 20,000 B.C. The period which we are now to enter—the middle Palæolithic—was one in which the men of Europe worked their stone implements in a very characteristic style—the fashion and culture which is universally known by the name of Mousterian, because the workmanship, in its typical form, was found at an early stage of prehistoric exploration (1863) in one of the Vézère caves of France, Le Moustier. The Mousterian period was probably as long in its duration as the late Palæolithic and the Neolithic ages put together—twenty thousand years. The evidence on which this statement is based will become apparent as we proceed with this survey. Thus, we are writing under the belief that the Mousterian age commenced some forty or forty-two thousand years ago. Very probably these estimates may need readjustment in the light of further discoveries.

A number of circumstances may be mentioned in order that the reader may form some conception of the duration

of the middle Palæolithic or Mousterian period. In the early phase of the Mousterian culture Europe had a warmer climate than it has now ; by the time this culture had evolved into another phase, the temperature had so fallen that the Arctic conditions of the Würm glaciation spread southwards as far as the Thames valley. The Mousterian culture persisted all through the Würm glaciation, and only disappeared when a milder interval brought the Aurignacian culture. This, in turn, as we have already seen, was replaced by the Magdalenian culture, which came in with the final and temporary return of an Icelandic climate. Thus the Mousterian culture lasted the round of a climatic cycle, and whatever may be the cause of changes of the climate of Europe we cannot conceive of them happening in a short period of time.

Not only did the Mousterian period cover a climatic cycle ; within its span lay a round of movements involving both sea and land. When it commenced, the Thames was over three miles wide at London Bridge ; the tide lapped round the high ground on which St Paul's stands. If this condition were to return, half of London would disappear ; all buildings standing on or below the 50-foot level would be submerged or become uninhabitable. At this low level, 50 feet lower than at present, England—at least southern England—had stood for a long time before the arrival of the people of the Mousterian culture. It was during their time that a movement of land elevation set in—one which gradually raised the site of London and the Thames valley, not only to their present level, but 50 feet above the level of river and sea we are now familiar with. Not only was there this land elevation, amounting to about 100 feet, but the people who practised the Mousterian culture saw a reverse movement set in, and by the time their culture came to an end a subsidence of the land had brought our valley not only back to its present level, but 20 or 25 feet below where it now stands. We do not know the cause of the earth pulsations which cause land and sea movements ; but they are slow in their progress. When we see that the span of the

Mousterian culture covers a period in which a great part of Europe was raised 100 feet and then gradually subsided again 75 feet, we have reason for regarding twenty thousand years as none too much for the programme of events here set forth.

The Mousterian culture throughout this long period went on evolving slowly. Archæologists recognise at least three phases in its evolution—early, middle, and late. Perhaps one reason for its slow evolution, as we shall see presently, was the kind of man who practised this culture. He was big-headed yet a low type of man, quite different from any race now living. He was not an ancestor of ours but a distant cousin ; we have to go far back in time—to a dawn-form of mankind—to find a type which will serve as a common ancestor for him as well as for ourselves. With this brief introduction we must now set out in our search for men of the Mousterian period—first in England, then on the Continent.

The story of late Palæolithic man, as told in the last chapter, came to an end on the low or 20-foot terrace of the north bank of the Thames, at the Admiralty buildings. The scene of our search for the records of his predecessor—Mousterian man—lies also in the Thames valley, on the south bank of the river, ten or twelve miles below London. In this region the North Downs invade the valley of the Thames, exposing their flanks to the enterprise of the makers of cement who have attacked them from the strips of flat land bordering the river. We may complain of the pestilence of smoke with which these manufacturers—both of brick and cement—fill the valley below London, but as students of ancient man we are deeply indebted to them. Without them, we should never have known that in the stretch of bank which faces the full tide of traffic on the Thames, early man has left his records more abundantly than in almost any other part of the world. The manufacturer has exposed the ancient work-floors and the scattered stone implements, but the recognition of their nature and significance has been the work of an army of voluntary

students and collectors who, in a brief history like this, scarcely receive the mention their labours have well earned.

The records of the Mousterian period—the one which is to engage us in this chapter—lie in this stretch on the south side of the Thames valley, especially in a side recess where the Darenth, breaking through the North Downs from the Weald of Kent, receives a tributary—the Cray—and joins the Thames (fig. 57). On the western or

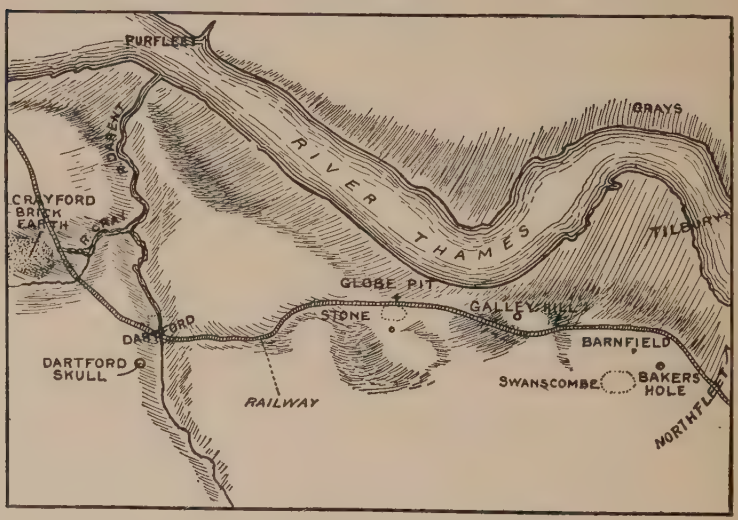

FIG. 57.—The reach of the Thames above Gravesend to show the sites of ancient man.

London side of the Darenth estuary have been deposited the Crayford brick earths, rising 60 feet (18 m.) above the level of the river. Those brick earths, deposits of the ancient Thames in times of flood, have been studied by many men, but the authorities who are to be our chief guides are three in number: firstly, Messrs Hinton and Kennard,[1] and secondly, Mr R. H. Chandler.[2] In fig. 58, I have combined the diagrams those authorities have drawn embodying observations which they have made at Crayford. We see, in the first place, the submerged

[1] See reference, p. 165.

[2] See reference, p. 165.

Neolithic surface, with the horizon of Tilbury man indicated, although Tilbury is a few miles lower down the river, and on the opposite or northern bank. Then comes, in point of antiquity, the low or 20-foot terrace—the terrace in which the Halling man of the Aurignacian period was found, but I must also state that the representation of this terrace at Crayford has been washed away by the Thames long ago. Then, above the level of the low or 20-foot terrace come the Crayford brick earths,

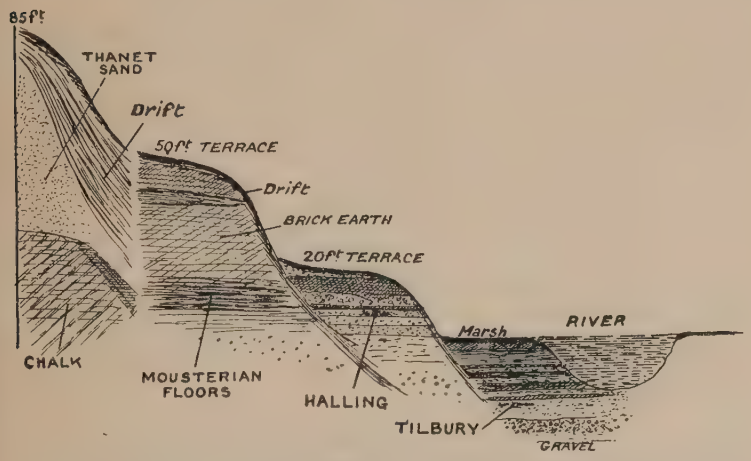

FIG. 58.—Diagram showing the submerged bed, the low or 20-foot terrace, the middle or 50-foot terrace in the valleys of the Thames and Medway. (After Hinton, Kennard, and Chandler.)

representing a still older deposit of the Thames—the middle or 50-foot terrace. We must examine the structure of this terrace. In the first place, its lowest layer or stratum is made up of gravel—the ballast gravel which marks the ancient bed of the river. That gravel rises now 30 feet above the present level, not of the bed of the river, but of the river itself. When the beginnings of the middle terrace were being laid down, the Thames was flowing on a bed at a level of 50 feet above its present bed. Then, above the gravel bed, follow strata of sand, about 14 feet in depth, indicating that the river was flowing more slowly—the land was

subsiding, and the valley was being filled up. Above the sands come another series of beds known as the Cyrena beds, containing in abundance the shells of certain molluscs and bones of small mammals. Then follow the typical brick earths—loamy deposits from the backwaters of a muddy and flooded river. From the gravel of the old river bed to the surface of the brick earth the deposits laid down by the river during a period of land subsidence amount to over 30 feet in depth. In all the strata of the 50-foot terrace, excepting only the gravels at the base, the men who lived on the south bank of the Thames worked their flint implements in the Mousterian manner. At all levels of the brick earths, these implements have been recovered. Messrs Hinton and Kennard, and Mr Chandler, recognised that the implements were Mousterian in type in 1905,[1] and their inferences were fully supported by the collection of implements which Mr Brice Higgins obtained from all horizons of the Crayford brick earths, and which have been described and recorded by Mr Reginald Smith.[2]

The section of these brick earths as recorded by Mr Chandler and Mr Leach [3] (see fig. 58) throws a very definite light on the climate both before and after the formation of the 50-foot terrace. Over the brick earths lies a deposit technically known to geologists as a drift or "trail"—a mixture of chalky blocks, gravel, sand, and sludge. Such a deposit results from the freezing of a surface soil, which in the thaw slips bodily down from higher to lower ground. After the Crayford brick earths were deposited, there evidently followed a cold period—marked by the formation of trail. We have seen, from the Arctic beds in the low terrace at the Admiralty buildings, and from Mr Warren's discovery in the low terrace of the adjoining Lea valley, that during the Magdalenian period there was a return to a sub-Arctic climate. The drift or covering over the Crayford brick

[1] See reference, p. 165.
[2] See *Man*, 1914, vol. xiv. p. 4 and p. 31.
[3] See *Proc. Geol. Assoc.*, 1912, vol. xxiii. p. 186.

earths may have been produced then; at least it was formed after the lower terrace was finished, for that terrace shows no disturbance of ice action in its upper strata.

Not only is there a trail over the Crayford brick earths, but, as Mr Chandler shows in his section (fig. 58), and as has been recognised for a number of years, there are the most definite signs of another drift or trail—a frozen landslide—on the side of the valley, occupying a period in time prior to the deposition of the Crayford brick earths in which the tools and culture of Mousterian man are embedded. This earlier trail or ice-deposit is known in England as "Coombe rock"—a mixed, contorted mass of chalk, sand, and loam, the results of a partially thawed landslide. Even before the period of the earlier trail, Mousterian man was in the valley of the Thames, for under the Coombe rock occur his old work-floors.

Five miles lower down the valley—almost opposite Tilbury—there is another deposit of brick earths, which, like those at Crayford, form part of the 50-foot or middle terrace. They occur on the western bank of a side valley by which the Ebbfleet enters the Thames, being exposed at an excavation or pit known as Baker's Hole (fig. 57). Here, under the Coombe rock, were found several thousands of Mousterian implements—evidently representing a tool manufactory or workshop of this remote period.[1]

When preparing the first edition of this work in 1914, rumours reached me that a human skull had been found deep in the Coombe rock of Baker's Hole, but it was not until quite recently, thanks to the generosity of Mr A. C. Hinton and of Mr Frank Corner, that I had an opportunity of making a close examination of this very important specimen. No one is more familiar with the Pleistocene animals found in the terraces of the Thames valley than is Mr Hinton; in this department of knowledge he is our leading authority. Although the exact level at which

[1] See *Archæologia*, 1911, vol. lxii. p. 522; also G. C. Robson, *Trans. Oxford University Junior Scientific Club*, June 1910, p. 337.

this skull lay in the Coombe rock is not known, its mineralised condition is, in Mr Hinton's opinion and also in my own, exactly similar to that of the bones of mammoth and rhinoceros which occur in this deposit. The skull lay deep in the Coombe rock, but above the main floor which carried such a profusion of the earliest types of Mousterian implements, and yet below the uppermost level at which implements of this culture did occur. If the skull had proved to be that of Neanderthal man, then we should have had no hesitation in supposing that at

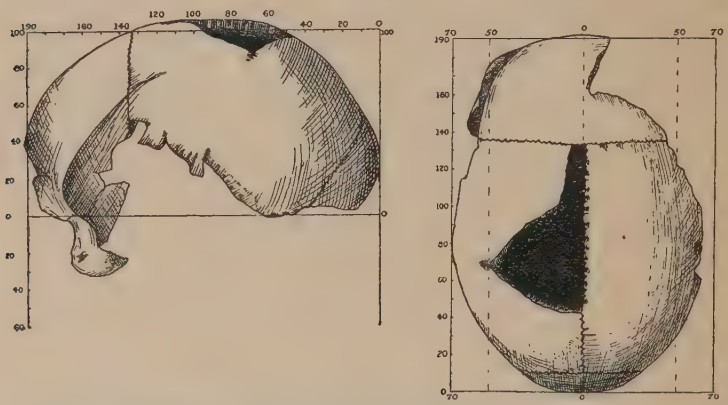

FIG. 59.—Profile of the Baker's Hole skull oriented on the sub-cerebral plane, with a view of the vertex, on the Frankfort plane.

last we had found an Englishman of the Mousterian period. I had a lively hope that this might prove to be the case. A glance at the actual specimen was sufficient to convince me that the man's skull which had been found embedded so deeply in the Coombe rock at Baker's Hole was of the same type as that we meet with in deposits of the late Palæolithic period. As may be seen from fig. 59, the skull belongs to a type we are already familiar with. Although its base and a part of the forehead are missing, yet there can be no hesitation in fixing its original length at 195 mm.—a long skull. The supra-orbital ridges, although strongly developed, were not more so than is often to be seen in the foreheads of

living men. In this ancient man the forehead was of good width—100 mm.—and the brain capacity of the skull was 1490 c.c., slightly above the modern average. As regards shape, the head was long and narrow—the width, 140 mm., being slightly under 72 per cent. of the length. The sides were nearly vertical in their ascent; the vault was comparatively flat, its highest point rising 118 mm. above the ear passages. Thickness of the roof varied from 6 to 8 mm., but just over the centre of the parietal bone it reached a thickness of 11 mm. The man, whose skull-cap has been thus recovered from the 50-foot terrace of the Thames valley, undoubtedly belonged to the type found at Engis, Langwith, and in the caves of the Mendips. The deposit in which his remains were discovered was sprinkled with implements which were shaped in the Mousterian manner. The most likely explanation of this relationship is that the man had been interred in the deposit by people of the Aurignacian period. There is, however, another possibility we have to keep in mind: Was the Mousterian culture in England the work of men of our type? On the Continent this culture is always associated with men of the Neanderthal type.

From the study of the deposits in the valley of the Thames, we are able to form some conception of the position which the Mousterian period occupies in the scale of prehistoric time (fig. 264, p. 717). It is manifest that this period is older than the formation of the low or 20-foot terrace, for when the middle or 50-foot terrace is traced towards the river, it is found to dip under, and therefore to have been deposited before the lower or more recent terrace. The duration of the Mousterian period was sufficiently long to cover a period which saw a wide variety of climatic changes in England. The 50-foot terraces on both sides of the river are all that remain of the great bed of deposits laid down in the valley during the time the men of England were in that stage of culture called Mousterian.

The south side of the Thames valley is not the only place where old Mousterian work-floors have been found.

In drawing up a list of the deposits of the Thames valley, arranged in their order of formation, Messrs Hinton and Kennard [1] mention the discovery of Mousterian floors on the north bank of the Thames—at Grays, almost opposite Crayford, at Stoke Newington, over which northern London has extended, and at Acton, to the west of London. In 1923–24 Mr W. H. Cook discovered a most extensive Mousterian floor in the valley of the Medway—on the high chalk bank which rises up from the river immediately opposite the town of Rochester. No true cave-habitation of this date has been found in England, but near Mildenhall, in the county of Suffolk, East Anglia, Dr Allen Sturge found a Mousterian work-station or floor.[2] The brick earth, fully 30 feet in depth, in which the flints were found by Dr Sturge, is situated on the side of a low hill which rises on the eastern slope of the valley of the Lark—a tributary stream of the Great Ouse. The Mildenhall brick earths are of the same geological age as those at Crayford. Further, as Dr Allen Sturge discovered, they have been overwhelmed by a glacial movement, just as the brick earths at Crayford were covered over by "drift." Several Mousterian floors have been discovered in the neighbourhood of Cambridge, Peterborough, and Ipswich,[3] all of them embedded in valley-deposits.

Thus we have the most ample evidence that England was inhabited by men who practised the Mousterian culture; but so far not any certain trace of their actual bodies have been found. That is the more strange, seeing that remains of the animals of the period are well preserved in the brick earths which contain Mousterian flints. Two forms of elephants occurred with him in the Thames valley—the mammoth and a form nearly allied to the African elephant (*E. antiquus*); three forms of the rhinoceros; the musk ox, and other mammalian

[1] "The Relative Ages of the Stone Implements of the Lower Thames Valley," *Proc. Geol. Assoc.*, 1905, vol. xix. p. 76.

[2] See *Proc. Prehist. Soc. East Anglia*, 1911, vol. i. p. 69.

[3] Mr J. Reid Moir, *Man*, 1920, vol. xx. p. 84.

species associated with a cold climate.[1] "In the brick earths of the middle terrace of the Thames," writes Mr Hinton,[2] "we meet with evidence of the invasion of England by swarms of mammals which can only have come from Siberia and Eastern Europe—the lemming, numerous voles, the reindeer, and the saiga antelope." At some part of the Mousterian period—perhaps during its whole extent—England was part of the Continent; otherwise such an invasion of mammals which were then new to this country could not have taken place. We see, therefore, that Mousterian man and his culture could have entered England by land.

To study the men of the Mousterian times, we must transfer the scene of our inquiry to the Continent—preferably to that part of France we have already visited in search of the men of the later Palæolithic periods, the region drained by the Dordogne and its tributaries (fig. 60). A little over sixty miles from Bordeaux, the Dordogne receives a small southern tributary, the Couze. In the face of the terraced limestone cliff or hill on one side of this valley, at a site known as Combe Capelle (fig. 60), a Swiss archæologist, Herr O. Hauser, made an important discovery—one which serves exceedingly well to introduce us to the Mousterian period of France.

In the opening months of 1909, he commenced a systematic exploration of a terrace, almost on the summit of one side of the valley, which was known to yield numerous Palæolithic flints, and suspected to have served as a rock-shelter for ancient man. His excavation at the foot of the sheltering rock exposed the following strata (fig. 61): (1) a layer of soil, about a foot in depth, containing blocks of limestone detached from the face of the rock by exposure to wind, wet, and changes of temperature; (2) a stratum, over a foot in depth, containing flints and other evidences of the Solutrean culture—the one preceding the Magdalenian, the latter being unrepresented at Combe Capelle. Then followed three

[1] Messrs Hinton and Kennard, *Proc. Geol. Assoc.*, 1905, vol. xix. p. 83.
[2] *Proc. Geol. Assoc.*, 1907, vol. xx. p. 53.

strata belonging to various phases of the Aurignacian culture—the lower, the middle, and the upper—separated by two sterile deposits, showing that during two intervals the rock-shelter had been forsaken as a human habitation. At the bottom of the lowest Aurignacian stratum a

FIG. 60.—A sketch map of the chief sites of prehistoric discovery in the region of the Dordogne, France.

human skeleton was found, with the clearest evidence that it had been buried. As was the custom in those times, the site selected for the grave was near the place of habitation. The position of the skeleton was much the same as at Halling, the knees being bent and the thighs drawn up. He, the dead man, had been provided with abundance of flints, and the perforated shells, which

probably ornamented his body in life, were close by. What is most important for our present inquiry is that

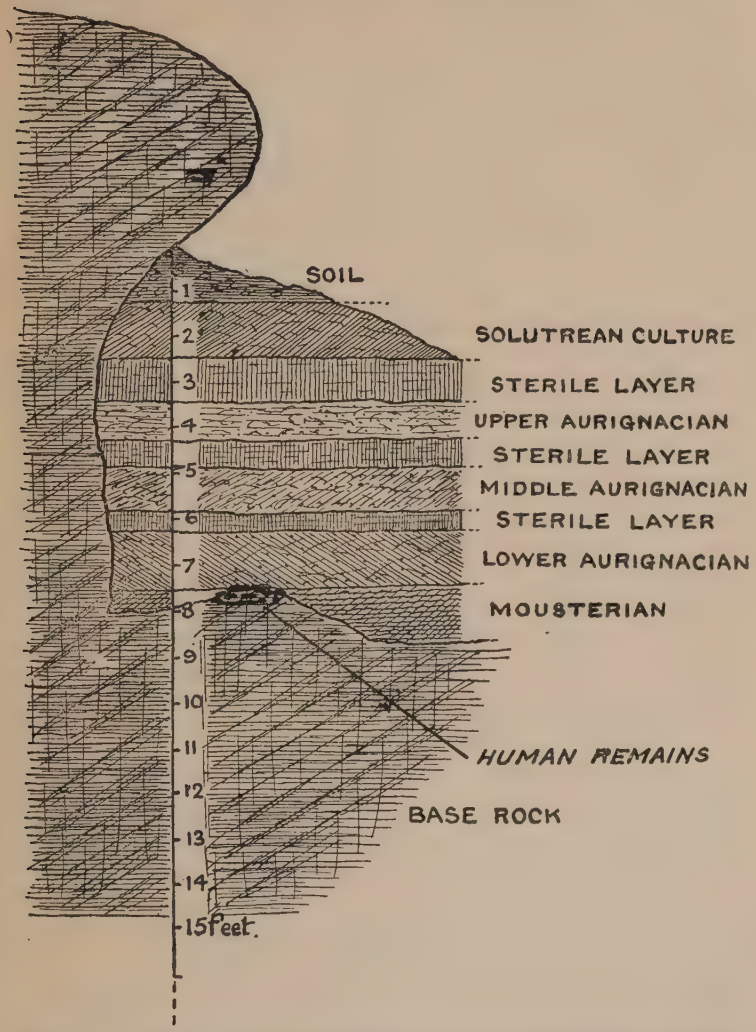

FIG. 61.—The strata at the rock-shelter at Combe Capelle, showing the position of the human skeleton discovered by O. Hauser.

the bottom stratum of all contained, not objects of the Aurignacian culture, but of the preceding or Mousterian

civilisation. Indeed, one of the implements which lay near the skeleton, and was probably interred with the body, was a Mousterian " point "—a small, wedge-shaped, flint implement or scraper.

On the evidence observed and recorded by Herr Hauser,[1] we must regard the man found at Combe Capelle as representative of a native of the Dordogne about the beginning of the Aurignacian period. The type is familiar to us—it is a variant of the modern-looking, narrow-headed men of the Aurignacian period, a type which would excite no comment, if dressed in modern garb, in any assemblage of modern Europeans. The head is merely a variety of the Engis type and of other late Palæolithic skulls found in England. It is a type, too, which occurred in Malta during the Neolithic period and which still abounds amongst modern Sardinians. The length of the skull, 198 mm., is 6 mm. longer than the Langwith specimen ; its width is only 130 mm.—5 mm. narrower.[2] The narrowness of the head is very apparent when a comparison is made of the width and length—the width is only 65·7 per cent. of the length, a narrower head than even that found at Langwith. The vault of the skull is well sprung, its height above the ear-holes being 120 mm. The brain capacity is about 1440 c.c.—slightly under the modern average. The facial features are those we are familiar with to-day. The size of the teeth and development of the palate are average, the length of the palate being 51 mm. ; its width at the second molars, 64 mm. (see fig. 55, p. 147). The three molar teeth, measured along the line of the crowns, are 28·5 mm. for the upper, 34 mm. for the lower—rather more than is usual in modern dentitions. He was a man of small stature, unlike the Cromagnon type, also of the Aurignacian period, but in this respect like the river-bed people and the so-called negroids of Grimaldi. The length of his thigh bone is only 425 mm. ; his stature, a

[1] *Praehistorische Zeitschrift*, 1910, vol. i. p. 273.

[2] For full description of skeleton, see Professor Klaatsch's account, *Praehistorische Zeitschrift*, 1910, vol. i. p. 285.

little over 1550 mm. (5 feet 2 inches). Thus, we see, at the close of the Mousterian period and at the beginning of the Aurignacian the men in the Dordogne valley were people of modern types—the Cromagnon people, tall; the Combe Capelle, short.

In the autumn of 1909, while Herr Hauser was exposing the Aurignacian man at Combe Capelle, M. Peyrony, the schoolmaster at Les Eyzies, the picturesque cliff village on the Vézère, was uncovering a human skeleton in a stratum of Mousterian age. M. Peyrony had devoted many years to the exploration of the prehistoric sites along the valley of the Vézère, and, at the time of which I write, the autumn of 1909, was exploring the deposits at the foot of a rock-shelter at La Ferrassie (fig. 60), on the western side of the valley, four miles above the point at which the Vézère joins the Dordogne, and nearly twenty miles to the north of the site at which Herr Hauser was excavating. M. Peyrony worked in conjunction with Professor Capitan of the Collège de France, Paris. The deposits at the rock-shelter showed the following strata [1] (see fig. 62). The upper stratum, 4 feet in depth, was made up of soil, with blocks of limestone which had fallen from time to time from the face of the sheltering rock. Then followed three strata of Aurignacian age—representing three phases of the culture of that time—forming a thickness of 6 feet. At a depth of 10 feet came the deposit which particularly interests us here—a deposit of the Mousterian period. It was about 20 inches in thickness, and contained the typical flint implements and chips of the period, with broken fragments of the bones of reindeer, bison, and horse—remnants of ancient feasts. In the lower part of this stratum a skeleton came to light, lying on its back with the lower limbs strongly bent. There was no evident sign of grave furniture or of deliberate burial, but we may be certain, seeing that a complete skeleton was represented

[1] For an account of this station, see *Revue Scientifique*, 1910, vol. xlviii. p. 193; *Bull. et Mém. Soc. d'Anthrop. Paris*, 1910, ser. 6, vol. i. p. 48. The skeletons are also described by Professor Boule (see reference, p. 174).

and that the strata had been the site of human habitation, that the body had not been entombed by natural means. Unfortunately, the skull was broken, but was repaired sufficiently to permit a cast of the brain cavity being made. The brain was large. Other parts of the skeleton were fairly complete, every bone being marked by those

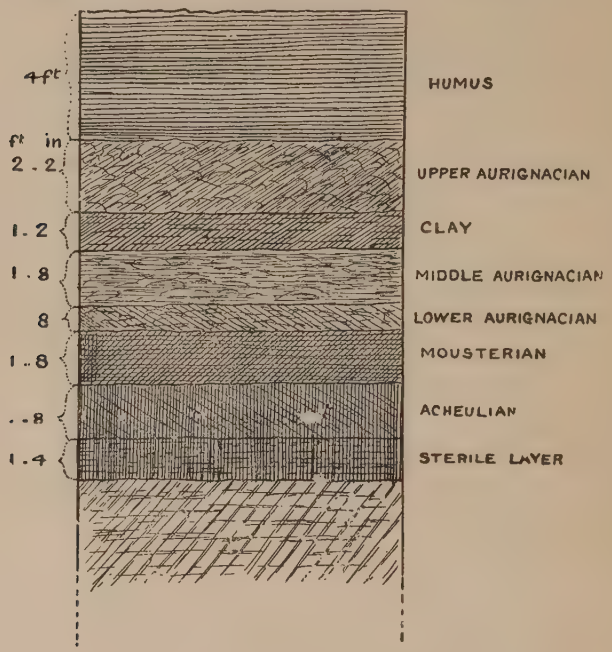

FIG. 62.—Section of the strata at La Ferrassie.

peculiar characters which denote, as Professor Capitan recognised, the Neanderthal race. In the same stratum, another skeleton showing Neanderthal characters was discovered in the following year, 1910. This proved to be the skeleton of a woman; parts of three children were also recovered. Thus, almost in the same month, and less than twenty miles apart, ancient human skeletons were discovered, two at La Ferrassie and one at Combe Capelle. The last named was found in the oldest Aurignacian stratum, and belonged to a man akin to

modern races, while the skeletons found at La Ferrassie, in the Mousterian stratum, were of a race or type totally different from any human race now living. In both cases these human remains had been folded down between untorn and undamaged pages of the records which Nature makes of the earth's history. As will be seen by a comparison of figs. 61 and 62, the La Ferrassie record is the older. Men began to live at the rock-shelter of Combe Capelle in the Mousterian period; their records cease at the Solutrean. At La Ferrassie, the records begin in pre-Mousterian times—it was inhabited when the characteristic hand-axes of the Acheulean culture were fashioned; the records at Ferrassie close with the Aurignacian period.

It was not the discovery at La Ferrassie, however, which drew the attention of Europe to the unexpected fact that the Neanderthal type of man was immediately succeeded by men of the modern type. The credit of having first demonstrated that Neanderthal man was not converted into modern man, during the middle part of the Pleistocene period, must be assigned to Herr O. Hauser and his colleague, the late Professor Klaatsch of Breslau. In 1908, the year before the exploration at Combe Capelle, Herr Hauser was excavating on the west bank of the Vézère, fifteen miles above La Ferrassie, in a cave on the lower terraces behind the little town of Le Moustier.

The site he had chosen was situated at a lower level than the famous cave investigated by Lartet and Christy in 1863, where they found the types of flint workmanship which are now regarded as characteristic of the Mousterian period. Early in 1908, Herr Hauser's workmen began to expose, at a depth of 5 feet below the floor of the cave, and accompanied by objects of the Mousterian period, a human skeleton. Further excavation was stopped until the autumn, when, surrounded by a company of German anthropologists, in the heart of France, the skeleton was finally extracted from its ancient bed, with expert eyes looking on to bear witness to its

authenticity and antiquity. The skeleton was that of a lad of perhaps sixteen years of age; his canine teeth and third molars were not fully erupted; the growth lines of the long bones were unclosed. There could be no question: he had been deliberately buried. Near his right hand was a hand-axe of the Acheulean culture, but typical implements of the Mousterian period were near by. Charred remains of the ancient ox—the urus—were noted. The body had been laid on its right side, with the face turned down, and a pillow of stones placed under the head. The skull was badly crushed, and Professor Klaatsch was not altogether fortunate in the reconstruction of its fragments. The head was remarkably large and capacious, and showed all the curious features of the Neanderthal race. Every bone of the body, as Professor Klaatsch has described in great detail,[1] showed certain features which differentiate them from the corresponding bones of modern man. The skeleton, or what remained of it, was subsequently acquired by the Museum of Ethnology, Berlin, where it is now preserved. A more accurate reconstruction of the skull has been made. Herr Hauser's discovery of a Neanderthal skeleton in a stratum of Mousterian age in 1908, and, in the following year, of a skeleton of the modern type in a stratum of Aurignacian age, effected a revolution in our attitude towards the nature of Neanderthal man, and our conception of the antiquity of men of the modern type.

In the autumn of 1909, while these explorations were being carried out at La Ferrassie and at Combe Capelle, discoveries of even greater importance were being made higher up in the valley of the Dordogne. The Vézère, as we have seen, is a tributary of the Dordogne. Seventy miles higher in its course, the parent river is joined by another tributary from the north—a small one—the Sourdoire, which has carved a valley out of an agricultural country—a plateau of limestone in the department of Corrèze. For some years three excellent archæologists,

[1] *Archives für Anthropologie*, 1909, ser. 7, vol. iv. p. 287. *Ergebnisse der Anatomie und Entwickl.*, 1907, vol. xvii. p. 431.

the Abbés A. and J. Bouyssonie and Bardon, then stationed in that part of France, had investigated local sites of prehistoric man with great skill and success. In the autumn of 1908, they were exploring a small cave, situated in a terraced field rising on the side of the valley of the Sourdoire, near the rustic village of La Chapelle-aux-Saints (fig. 60). The cave was of small dimensions—even when cleared out it was not high enough for a man to stand erect in. At its widest part it only measured about 13 feet (4 m.), whilst the furthest recess was less than

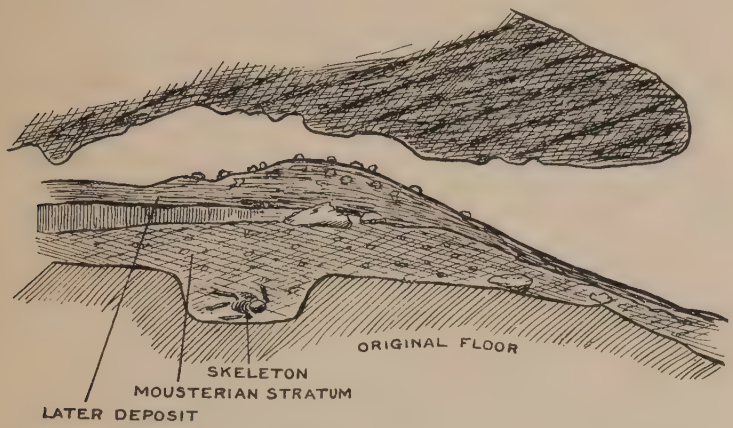

FIG. 63.—Section of the cave at La Chapelle-aux-Saints (Boule).

20 feet from the low entrance on the face of the limestone terrace. The deposits on the original floor were about 3 feet in depth, and exhibited two strata or zones (fig. 63) —an upper one, rather less than 2 feet in depth, and a deeper, a little over a foot in thickness. The upper stratum was sterile so far as our present inquiry is concerned, but the deeper, a yellowish clay laden with remains of extinct animals and implements of the Mousterian culture, has an immediate bearing on our search. The animals represented in the deeper stratum were the woolly rhinoceros, the reindeer, a Pleistocene form of horse, the boar, the ibex, the bison, the cave-hyena, and the Alpine marmot. The implements, over

a thousand in number, were the typical products of the Mousterian period—the Mousterian "points," scrapers, and flakes. The remains of two distinct hearths were noted near the level of the original floor.

The Mousterian stratum was observed to dip down into a depression in the floor, near the centre of the cave (fig. 63). In this depression, the abbés exposed the skeleton of a man—again of the Neanderthal type. The body had been laid on its back, head to the west, and with knees, thighs, and elbows flexed—the contracted posture. The head was protected by an arrangement of flat stones, near which was part of the skeleton of the leg and foot of an ancient type of ox. Other stones were placed round the body, between it and the sides of the depression in the floor—regarded by the abbés as a grave purposely dug for the body. Numerous beautifully worked flints of the Mousterian period lay near the skeleton. The Mousterian stratum over the gravel was intact; the cave had been occupied in the Mousterian period long after the body had been laid to rest. Even at this early period, a species or kind of man, not directly related to modern races, was burying his dead and furnishing them with an outfit as provision for a long journey. The human mind, even then, held hopes and beliefs as to what happened after death. Clearly the Mousterian period and Neanderthal man do not represent the human dawn. Still, they belong to that remote date at which the middle terrace of the Thames valley—on which so much of central London is now built—was being formed by the action of the river.

The discovery at La Chapelle-aux-Saints marks a stage in the progress of our knowledge of ancient man. We see, in 1908, that the methods employed in the exploration of caves had become exact and systematic, replacing the somewhat haphazard efforts of an earlier period. The splendid memoir [1] written by M. Marcelin Boule,

[1] *Annales de Paléontologie*, 1911, vol. xi. pp. 1–270, 16 plates. Also *Fossil Men*, translated from the French with an introduction by Jessie Elliot Ritchie and James Ritchie, London, 1923.

Professor of Palæontology in the National Museum of Natural History, Paris, where the La Chapelle man now finds a home, represents the most thorough and exact investigation ever made of an ancient human skeleton. The man of La Chapelle-aux-Saints was worth all the pains which Professor Boule has bestowed on him. The skull was broken, parts of the face were defective, some parts of the skeleton were missing, but such blanks were supplied by the two skeletons of adults found by MM. Capitan and Peyrony at La Ferrassie. Professor Boule estimates the age of the La Chapelle man at fifty or fifty-five years, but the open condition of the sutures between the bones of his massive skull suggests a younger age—perhaps under forty. For such an age, the teeth, which were planted in jaws of exceeding strength and size, are in a surprisingly bad state. All the molar or chewing teeth had been lost from disease during life. The dimensions of the skull (see fig. 70, p. 201) greatly exceed those of an average modern man. The maximum length is 208 mm.; the width, 156 mm., represents 75 per cent. of the length; the skull being thus, in spite of its great length, on the border line which separates the long-headed and medium-headed groups. The height of the vault above the ear-holes is about 118 mm.—a low amount for such a long and wide skull. The great capacity—over 1600 c.c., at least 120 c.c. above the modern average—seems inconsistent with the great beetling, ape-like eye-brow ridges and massive jaws. Nor was it a simple brain. The cast taken from the interior of the skull—the subject of a special memoir by Professor Anthony [1]—shows that all the parts of the human brain were already fully represented. Like all men of the Neanderthal race,[2] the La Chapelle man was not tall—under 5 feet 4 inches (1·600 m.). He had many characters which may justly be called simian or primitive, but he had others which cannot be so classed—such as the size of the brain and the relative proportion of the limbs. In apes, in certain modern and ancient races—such as the Cromagnon people of the

[1] *L'Anthropologie*, 1911, vol. xxii. p. 1.

[2] See p. 221.

Aurignacian period—the forearm and leg are relatively long as compared with the upper arm and thigh, but in Neanderthal man the forearm and leg are relatively short, even when a modern European is taken as the standard.

In the evidence provided by the discoveries at Le Moustier, La Ferrassie, and La Chapelle-aux-Saints, one is forced to the conclusion that the Dordogne, during the Mousterian period, had as its sole inhabitants men of the Neanderthal type; in the succeeding period—the Aurignacian—men of the modern type took their place. At least, men of the modern type have never been found in a stratum of Mousterian age in this region; only remains of Neanderthal man have been so found. Such an inference has the further support of discoveries made by Dr Henri Martin [1] in the Department of Charente, adjoining the Department of the Dordogne on the north-west (fig. 60). For fifteen years, from 1905 onwards, Dr Martin explored a deposit of the Mousterian age, situated at the foot of an old rock-shelter at La Quina and buried under débris which had fallen from the cliff. Along the valley and near the cliff flows a small stream—the Voultron—on its way to join the Dronne, another of the northern tributaries of the Dordogne. The deposits at La Quina showed three strata, belonging to different phases of the Mousterian period. Dr Martin found not only the typical implements of the middle and later stages of the period, with remains of the reindeer, the horse, and primitive ox (*Bos primigenius*), but also rude implements worked in bone. In 1910, he found a human astragalus or ankle-bone which was recognised by its peculiar form to be that of a man of the Neanderthal type—so distinctive is the structure of this race. In September 1911, two years after the famous discoveries in the region of the Dordogne, Dr Martin found in the lowest part of the deeper of the two Mousterian strata, a human skeleton, again of the Neanderthal type. The bones were embedded in a greenish sandy clay, a silt deposited in the bed of the Voultron when that stream

[1] *L'Homme fossile de la Quina*, Paris, 1923.

flowed nearer to the foot of the rock-shelter than it does now. The discoverer formed the opinion that the body had fallen in the stream and had thus become naturally entombed. When we remember the instances already cited, where men of both the Mousterian and Aurignacian periods have buried their dead near or under the sites of habitation, we are inclined to regard La Quina as a similar case—one of burial. Altogether parts of about twenty individuals were found. The skull of a child aged eight years shows distinctive features; the supra-orbital ridges are already in process of development, and the eye-sockets are remarkably large.[1]

The skeleton found at La Quina is probably that of a woman—the first of her race to be discovered in France. Neanderthal women, we shall see, have also been found elsewhere—in Croatia. Probably, too, the Gibraltar skull is that of a woman. We are familiar with the sexual differences which distinguish the average modern man from the average woman. Our knowledge is founded on the study of hundreds of individuals. When a totally new form of mankind is discovered, we cannot foretell the manner or the degree of sexual differentiation. Hence the uncertainty as regards the sex of the individual represented by the La Quina skeleton. The skull is long, 203 mm.; rather narrow in comparison with the length, 138 mm., giving a head index of 68. The eye-brow ridges are as greatly and prominently developed as in male skulls, and such is not the case in skulls of modern women. The jaws of the La Quina woman are strong and the teeth big. The bones of the vault of the skull are about 5 mm. in thickness, the same as in modern skulls of average thickness, whereas in the skulls of Neanderthal men in particular and Palæolithic men in general, the vault has a thickness of 8 or 10 mm. The brain capacity of the skull is estimated by Professor Anthony [2]

[1] *Bull. et Mém. Soc. d'Anthrop.*, 1920, sér. vii. t. i. p. 113; *L'Anthropologie*, 1921, vol. xxxi. p. 331.

[2] The brain is fully described by Professor Anthony. See reference, p. 613.

at 1350 c.c., about the same as for modern women, but 250 c.c. less than the capacity of the La Chapelle man's skull. The stature is calculated to have been 1·500 m., about 5 feet.

The four years between 1907 and 1911 witnessed a remarkable series of discoveries of Neanderthal man in

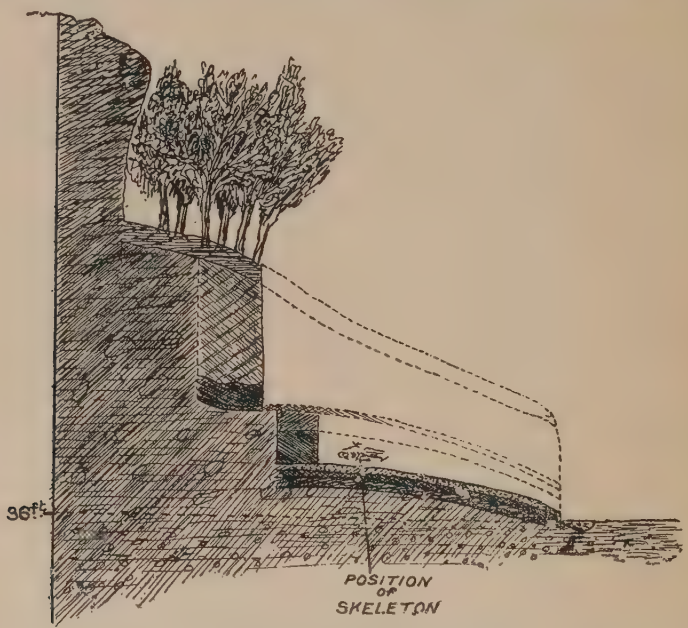

FIG. 64.—Section of the strata at La Quina, the strata removed during excavations being represented by stippled lines. (After Dr Henri Martin.)

France. All of them belonged to the Mousterian period. Before 1907, several important finds had also been made in France. The discovery of a lower jaw in a cave at Arcy-sur-Cure, in the Department of Yonne, carries the distribution of Neanderthal man to the centre of France. This find was made in 1859. In 1889, a lower jaw was discovered in the cave of Malarnaud, in the famous Department of Ariège, at the foot of the Pyrenees (fig. 60). In 1895, in a cave some distance to the west, at Isturitz (Basses-Pyrénées), M. l'Abbé Breuil discovered the lower

jaw of an individual of the Neanderthal race. In the same year as the Malarnaud specimen was discovered, M. Piette, who explored the Mas d'Azil deposits, found certain fragmentary bones of the face in a cave near Gourdon, in the valley of the Cean, a southern tributary of the Dordogne (fig. 60).

The list for France is complete when the discovery of three fragments of jaws by M. Favraud, in a Mousterian stratum in the Department of Charente, is mentioned.

CHAPTER IX

THE DISTRIBUTION OF NEANDERTHAL MAN IN EUROPE

In the light of those later discoveries of Neanderthal man in Mousterian strata of South-Western France, we may now proceed to give a brief review of similar finds made in other parts of Europe. Taking Spain first, there is only one discovery to note, but it is an important one. It is now proved that the skull found at Gibraltar in 1848 was the very first recorded discovery of the remains of Neanderthal man.[1] Colonel Kenyon, Commandant of the Royal Engineers at Gibraltar in 1910, found the following entry in the Minutes of the Gibraltar Scientific Society, dated 3rd March 1848 :—" Presented a Human Skull from Forbes Quarry, North Front, by the Secretary." The secretary then was Lieutenant Flint of the Royal Artillery. The skull was brought to England by Mr George Busk in 1862, and presented by him, in 1868, to the museum of the Royal College of Surgeons, England, where it is now preserved. The subsequent history of this specimen is instructive. Exhibited at scientific meetings in England and France, examined by Huxley, Broca, Busk, Falconer, who proposed the name of *Homo calficus* (from Calphe, the ancient name for Gibraltar),[2] the place of this skull among the records of ancient man did not become apparent until the twentieth century was well begun.[3] The late Dr Gustav Schwalbe, Professor of

[1] See *Nature*, 1911, vol. lxxxvii. p. 313.

[2] *Ibid.*, p. 314.

[3] For a full description of the Gibraltar skull, see Professor Sollas's account, *Phil. Trans.*, 1908, ser. B, vol. cxcix. pp. 281–339.

Anatomy in the University of Strassburg, had by then established the separate identity of the Neanderthal race.[1] Anthropologists gradually came to see that the Gibraltar skull—hitherto so obscure in its nature—was only a variant of the Neanderthal type. Further inquiries were made into its history. In 1910, Dr W. H. L. Duckworth [2] of Cambridge University explored the site of Forbes Quarry from which the skull came. He found the quarry was situated under the northern face of the famous rock —on the side looking across the flat tongue of land which joins the rock to Spain. Even in 1910—sixty-two years after the discovery of the skull—there could still be seen the remains of a cave in the limestone cliffs of the quarry. The operations carried out by the quarrymen also exposed a section across the débris of chips and blocks which had been detached from the face of the cliff and gathered at its foot as a cemented mass or breccia. In the floor of the cave Dr Duckworth found alternate layers of stalagmite and sea-sand, which had to be explored by blasting, so closely were the fragments cemented together. He found neither fossils nor implements there. In other caves, however, he did make an important discovery—namely, flints worked in the Mousterian manner. It was clear the rock had been inhabited in Mousterian times. The Gibraltar skull itself carries evidence of having come from the floor of such a cave as Dr Duckworth saw at Forbes Quarry: the nose and orbits are still choked with a mixture of sand, limestone, and cement, similar to the material in the floor of the cave. In the cemented matter on the skull there also remain shell fragments.[3] After sixty-two years of investigation we are now in a position to assign this remarkable document—the

[1] See *Verhand. der anat. Gesellsch.*, 1901, p. 44; also see reference, p. 192.

[2] *Journ. Roy. Anthrop. Instit.*, 1911, vol. xli. p. 350; "An Account of a Second Visit," *ibid.*, 1912, vol. xlii. p. 515.

[3] The north front of the Rock was visited by M. l'Abbé Breuil in 1914, 1917, and 1919. He examined the site of Forbes Quarry and discovered at some distance to the east a Palæolithic rock-shelter of Mousterian date. *Journ. Roy. Anthrop. Instit.*, 1922, vol. lii. p. 46.

Gibraltar skull—to its approximate place in time. All the skulls of the Neanderthal type have come from deposits of Mousterian age; we may allocate the Gibraltar individual to that period with some degree of certainty. Indeed there is now definite evidence that men of the Neanderthal type lived on the shores and islands of the Mediterranean during the Mousterian period. This culture has been discovered in various parts of Spain; a lower jaw, which Dr H. Obermaier ascribes to Neanderthal man, has been found in a deposit at Bañolas, south of the eastern end of the Pyrenees.

In spite of the numerous discoveries which have added to our knowledge of Neanderthal man, the Gibraltar skull still holds a unique place. In no other specimen is the base of the skull preserved. The base of the Gibraltar skull is remarkably straight and simian in its conformation (fig. 80).[1] The face, too, is less broken than in any other specimen (fig. 71). The nose is most capacious, and reminiscent, in the region of the face surrounding the nose, of the condition seen in the skulls of gorillas. Yet the upper jaw is not projecting nor simian; the face is not prognathous. The lower jaw, unfortunately, was never found, and a part is missing from the vault of the skull, leaving some doubt as to the exact size of the brain. On a former occasion I estimated the capacity by measuring the more intact half of the skull with millet seed, and found the brain space to be just under 1100 c.c.[2] At a subsequent date a brain cast was made of plaster; the cast displaces 1150 c.c. of water. The cast is too flat on the vault, and hence a little must be added—perhaps 50 c.c.—making the brain size about 1200 c.c. Professor Sollas and Professor Boule give slightly higher estimates —the former 1260 c.c., the latter 1296 c.c. The brain is smaller than that of any other Neanderthal individual

[1] See the investigations of Professor G. L. Sera, *Archivio per l'Antropologia*, 1909, vol. xxxix. pp. 5–66.

[2] See *Ancient Types of Man*, 1911, Harper Brothers. Also *Nature*, 1910, vol. lxxxiii. p. 88.

so far discovered. The La Quina specimen makes the nearest approach, with a capacity of 1367 c.c. Very probably, as Professor Sollas has supposed, the small brain may indicate that the skull is that of a woman. We shall return to some of the most peculiar features of the Gibraltar skull in another chapter.[1] The fact which we note at present is this, that, whether of the Mousterian or of an earlier date, we have in this specimen the most definite evidence that the Neanderthal type of man, like men of the modern type, was divided into local races or varieties, the Gibraltar race differing very materially from its allies—perhaps contemporaries—in Central and Southern France. As we look into the world of ancient man, the problems of human origin become more complex, and their solution more intricate and difficult. The world of ancient man, although its population was small, yet contained a large diversity of types, so different from the teeming millions of to-day which represent mere varieties of the same type.

In this cursory survey of Europe in search of the discoveries of Neanderthal man, we pass from Spain to Jersey. An elevation of 60 feet would unite Jersey with the west coast of Normandy by dry land—a union which has been made and broken many a time even in recent geological history. At St Brelade's Bay, on the south coast of Jersey, granite cliffs rise to a height of 200 or 300 feet. In a cleft on their face opens La Cotte de St Brelade—a cavern excavated by the sea when the waves beat against the coast, 60 feet above their present level. Until 1910 the cave was buried beneath a mass of rubble, 30 feet deep. The chance discovery of a flint implement on the beach below the site of the cave led to its exploration by the Société Jersiaise. Dr R. R. Marett of Oxford University has published a full and clear account of the discoveries at St Brelade.[2] In the deeper strata

[1] See p. 220.

[2] See *Archæologia*, 1911, vol. lxii. p. 449; vol. lxiii. p. 203; 1916, vol. lxvii. p. 75. Also E. T. Nicolle and J. Sinel, *Man*, December 1910, p. 185. *Bull. Soc. Jersiaise*, 1912, vol. xxxvii. p. 213.

of the cave representing ancient floors, remains of hearths were discovered. The prehistoric strata of the floor yielded an abundance of flint implements worked in the typical Mousterian manner. Remains of the woolly rhinoceros, the reindeer, a species of horse and of ancient ox, revealed the sources from which the ancient cave men drew their food supply. Near one of the hearths twelve human teeth were found, all of them parts of a single set, and all of them showing those peculiar features which stamp and distinguish the teeth of Neanderthal man.[1] The evidence from Jersey is thus in harmony with that obtained from the caves in France—the Europeans of the Mousterian period were people of the Neanderthal type. Further, we see that this peculiar human species reached the western seaboard of the Continent [2] in Mousterian times.

From Jersey we proceed to Belgium, where some most important discoveries of Neanderthal man have been made. In the Royal Natural History Museum at Brussels is preserved the famous specimen known as the Naulette mandible. Only the region of the chin and the left part of the body of the jaw remain—enough to tell us that it is from the face of a woman of the Neanderthal race. All the teeth had dropped from their sockets after death. The region of the chin and the teeth sockets show those peculiar features which mark the Neanderthal species of man. The Trou de Naulette, in which this specimen was discovered in 1866, is one of a series of great limestone caves visited by the modern tourist as he passes up the valley of the Lesse, on his way to the Ardennes, in the eastern part of Belgium. Its exploration belongs to the early period, 1865–1866, and was carried out by M. Edouard Dupont, aided by a grant from the Belgian

[1] See account of the teeth by Keith and Knowles, *Journ. of Anat. and Physiol.*, 1911, vol. xlvi. p. 2. Also *Bull. Soc. Jersiaise*, 1912, vol. xxxvii. p. 223. The characters of Neanderthal teeth are again mentioned at p. 210 of this book.

[2] For a general account, see *Prehistoric Man in the Channel Islands*, by J. Sinel, 1914. Another Jersey cave of Mousterian date is mentioned by Mr Sinel.

Government. The strata on the floor reached a great depth; the actual stratum in which the mandible was found lay 14 feet (4·50 m.) below the present surface. Remains of the mammoth, rhinoceros, bear, and reindeer occurred in the same horizon, and with them were found worked implements of the Mousterian culture. The Naulette jaw, like the Gibraltar skull, had to wait until the beginning of the twentieth century for its real nature to be recognised.

Twenty years later than the exploration of the Naulette cave a party of explorers from the University of Liège—Marcel de Puydt, Julien Fraipont, and Max Lohest—made a discovery of the highest importance. The Lesse, on which the Naulette cave is situated, joins the Meuse at Dinant (fig. 37, p. 105); fifteen miles farther down (northwards) is the busy town of Namur; thirty miles beyond Namur, Liège. The little valley in which the party from Liège made their famous discovery [1] lies about eight miles to the east of Namur. On the eastern side of the valley is a limestone cliff sheltering a cave—the "grotte de Spy." A terrace in front of the cave slopes down to the little stream which flows southwards along the valley. The skeletons of two men of the Neanderthal type were exposed in the terrace at a depth of 14 feet. Strata representing three different periods of ancient human occupation were passed through. The bodies lay on the hearths of the third stratum, a layer only 6 inches thick. Later, Dr Rutot [2] again examined the evidence relating to the antiquity of this stratum, and from the remains of the extinct animals, the workmanship of the flints, and also a piece of bone used as a human tool, concludes that the skeletons are of the same date as the men found at Le Moustier, at La Chapelle, and at La Quina. These Spy men were typical representatives of the Neanderthal species, with large, robust skulls, holding

[1] "Le race humaine de Néanderthal," par Julien Fraipont et Max Lohest, *Archives de Biologie*, 1887, vol. vii. p. 587.

[2] "La position réelle des squellettes de Spy," *Bull. Soc. Belge de Gé logie*, 1909, vol. xxiii. p. 235.

brains which, in point of size, were above the average of the modern European.

From Belgium we pass northwards to Germany. To reach the lower valley of the Rhine, where we propose to begin a survey of the discoveries of men of the Mousterian period in Germany, we may follow the Meuse northwards, or, as will suit our purpose better, pass directly to Düsseldorf, situated some sixty miles to the north-east of Liège. In the valley of the Düssel, which joins the Rhine at Düsseldorf, is situated the cele-

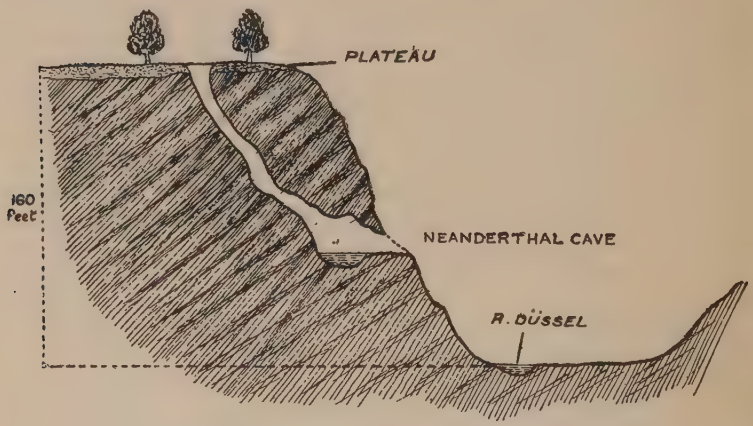

FIG. 65.—Lyell's diagram of the Neanderthal cave.

brated Neanderthal cave (fig. 37, p. 105). This northern tributary of the Rhine, after passing Elberfeld, and some distance above its termination, enters a deep ravine, with a limestone cliff on one side—the left or south side—rising to a height of 160 feet. At the time of the discovery, the early spring of 1857, the Neanderthal cave opened on the face of this limestone cliff, 60 feet above the level of the Düssel and 100 feet below the neighbouring plateau (fig. 65). By good fortune a physician in the adjacent town of Elberfeld, Dr Fuhlrott, was interested in fossil remains and in cave exploration, and kept a watch on a party of workmen who were quarrying near the cave. When the cave was cleared out, Dr Fuhlrott secured

from the workmen certain remarkable bones, which at first he did not believe to be those of a human being. They lay at a depth of 4 or 5 feet in the loam filling the floor of the cave. Dr Fuhlrott afterwards dispatched the various parts of the skeleton—the vault of a skull, right and left thigh bones, and right and left humerus (the left was imperfect), fragments of the pelvis, shoulder blade, and of ribs—to Professor Schaaffhausen of Bonn, an expert anatomist. Nothing was found in the cave or observed afterwards which gave a clue to the antiquity of the Neanderthal skeleton; no remains of extinct animals were discovered. No implements were seen or found, for at that time (1857) the various cultural phases of the Palæolithic period had not been recognised. Professor Schaaffhausen had no doubt as to the antiquity or humanity of the cave-bones from Neanderthal. In 1858,[1] he published an excellent description of them, in which the following passage occurs: "Whether the cavern in which they were found, unaccompanied with any trace of human art, was the place of their interment, or whether, like the bones of extinct animals elsewhere, they had been washed into it, they may still be regarded as the most ancient memorial of the early inhabitants of Europe."

Now that we are fairly certain as to Neanderthal man's place in time and his relationship to other human races, it is interesting to survey the original and classical discovery as it appeared to a contemporary spectator—keenly interested in the problem of man's antiquity—Sir Charles Lyell.[2] "I visited the spot in 1860," he writes, "in company with Dr Fuhlrott, who had the kindness to come expressly from Elberfeld to be my guide, and who brought with him the original fossil skull, and a cast of the same, which he presented to me.[3] From a printed letter of Dr Fuhlrott we learn that, on removing the loam,

[1] See translation of paper by Geo. Busk, *Nat. Hist. Rev.*, 1861, vol. i. p. 283. The original is in *Müller's Archives*, 1858, p. 453.

[2] *Antiquity of Man*, 1863, p. 76.

[3] Now in the museum of the Royal College of Surgeons, England.

which was 5 feet thick, from the cave, the human skull was first noticed near the entrance, and farther on the other bones lying in the same horizontal plane. It is supposed that the skeleton was complete, but the workmen, ignorant of its value, scattered and lost most of the bones, preserving only the larger ones. . . . On the whole, I think it probable that this fossil skull may be of about the same age as that found by Dr Schmerling in the Liège cavern ; but, as no other animal remains were found with it, there is no proof that it may not be newer. Its position lends no countenance whatever to the supposition of its being more ancient. . . . When, on my return to England, I showed the cast of the cranium to Professor Huxley, he remarked at once that it was the most ape-like skull he had ever beheld."

To Sir Charles Lyell the discovery of the skeleton was an isolated and puzzling event. He never guessed it was the first representative of a distinct race inhabiting Europe during a definite part of the Pleistocene period. We see, too, how narrowly the Neanderthal remains escaped destruction at the hands of the workmen, and how Huxley became interested in fossil man through Sir Charles Lyell. Huxley's contribution to our knowledge of Neanderthal man [1] is certainly one of the most complete and incisive analyses ever made of this peculiar fossil man. His final judgment was to the effect that, ape-like as many of the characters of the skull were, Neanderthal man was merely an extreme variant of the modern type of man, not a separate species or type. A contemporary of Huxley's, Dr William King, Professor of Anatomy in a remote college—Queen's College, Galway, Ireland—reached an opposite conclusion ; [2] but his quietly worded verdict was rendered ineffective partly by the vigour and emphasis of Huxley's statement, and partly because at that period men were not prepared for a prehistoric

[1] *Man's Place in Nature*, 1863. See also *Nat. Hist. Rev.*, 1864, vol. iv. p. 429.

[2] "The Reputed Fossil Man of the Neanderthal," *Quart. Journ. of Science*, 1864, vol. i. p. 88.

world peopled by different species and different genera of mankind. "So closely," Professor King wrote, "does the fossil cranium resemble that of the chimpanzee as to lead one to doubt the propriety of generically placing it with man. . . ." He was inclined to regard the Neanderthal remains as representing not a new species, but a new genus of mankind. He was content, seeing that only the vault of the skull was known, to create a new species—*Homo neanderthalensis*—for the reception of the new species of man discovered by Dr Fuhlrott at Neanderthal. Professor King did not know, however, what we are now well aware of, that Neanderthal man had a large and complex human brain, that he was a skilful artisan, that he buried his dead and held certain beliefs regarding death. If he had known those things he would not have written: "The Neanderthal skull is so eminently simian . . . I am constrained to believe that the thoughts and desires which once dwelt within it never soared beyond those of the brute." Professor King was not prepared to believe that a human brain might be wrapped in an ape-like skull, nor that human civilisation was so old that since its dawn mankind had lived long enough to become actually separated, not into distinct races, as we see in the world to-day, but into distinct species, of which apparently Neanderthal man represents merely one, while all the modern races of mankind represent a second.

The discovery of the Spy men in 1886, so similar in all their characters to the prototype found at Neanderthal, dissipated the idea which was held by many anatomists that the peculiar characters of the Neanderthal cave bones were due to the chance incidence of disease or to a disordered form of growth. It took sixty years to show that King was right and Huxley wrong. The researches of Professor Schwalbe, of Professor Klaatsch, and, more recently, of Professor Boule, have firmly established King's verdict—that Neanderthal man represents a separate species. Nor can we doubt, from what has been discovered in recent years, that the remains discovered in the Neanderthal cave belong to the Mousterian period.

A cave in the same locality yielded the remains of the extinct kinds of animals which are usually associated with implements of the Mousterian culture.

When it is remembered that the classical discovery of Neanderthal man was made in Germany, it is surprising that so few traces of him have been found in that country during the intervening sixty odd years. That he was widely spread throughout the southern parts of Germany, there cannot be any doubt, for over eleven stations or sites have been found which served him as work-floors. The most remarkable of all of these stations is on the lower valley of the Ilm, near Weimar, 200 miles to the east of Düsseldorf (fig. 37, p. 105). Some eighteen miles beyond Weimar, the Ilm joins the Saale—the latter, flowing northwards, joins the Elbe. We have therefore left the watershed of the Rhine and entered that of the Elbe. Five miles above Weimar, but on the opposite or southern bank of the Ilm, is the village of Taubach, where there are pits or quarries, the stone or material worked being a fine-grained sand mixed with chalk. This deposit or tufa was apparently laid down when the Ilm flowed through an inland lake. On the shores of this lake lived a race of Neanderthal men, for the workmen in the quarries come across numbers of his implements in the deeper strata—particularly in one which lies about 20 feet below the present level of the soil, and which appears to have been at one time a land surface (fig. 66). In this thin stratum of fine sand and chalk occur fossil remains of a fauna which tells in the plainest manner that Neanderthal man was living in the valley of the Ilm when the Germany of that time enjoyed a warmer climate than it now does. Fossil remains of the older elephant occur (*Elephas antiquus*), of an early form of rhinoceros (*Rhinoceros Mercki*), and of other animals which lived in Central Europe at the zenith of the long mild interval which separated the Mindel (first Pleistocene or Chellean) from the second Pleistocene or Mousterian glaciations (fig. 264, p. 717). All the evidence points to this discovery in the limestone quarries at Taubach, and in the lower valley of

the Ilm, as revealing the oldest Mousterian station yet known to us. We have fixed 50,000 B.C. as a provisional date for the dawn of the Mousterian culture in Europe, but at Taubach we seem to have passed beyond our provisional limit.

In the deep stratum (fig. 66), which yields fossil bones, flints fashioned in the Mousterian manner, and traces of ancient hearths, there were found two human teeth (see fig. 75, p. 210), a description of which was published

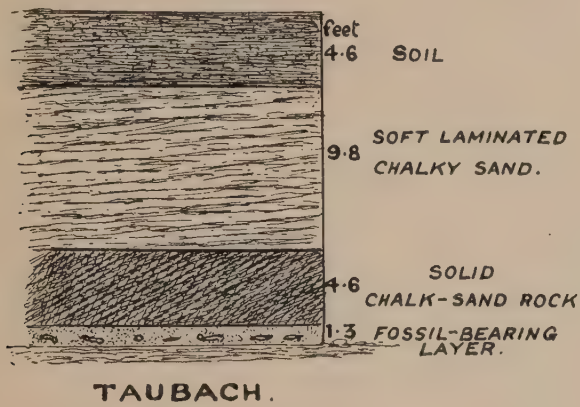

FIG. 66.—Section of the strata encountered in the limestone quarries at Taubach, with the bottom stratum on which the fossil bones and Mousterian implements occur.

by Dr Nehring in 1895.[1] These teeth have given rise to much discussion, some even assigning them to an extinct form of anthropoid ape, but that they belong to an early variety of Neanderthal man there can be now no doubt; a recent discovery at Ehringsdorf, a suburb of Weimar (fig. 37, p. 105), has put to rest any remaining doubt on this head. The limestone quarries at Ehringsdorf expose the same deposits as occur at Taubach, only they extend to greater depths. On the morning of 8th May 1914, a party of workmen were blasting rock in one of these quarries

[1] *Zeitschrift für Ethnologie*, 1895, vol. xxvii. p. 338. For an account of the Taubach strata, see *Aus dem Werdegang der Menschheit*, by Dr H. von Buttel-Reepen, Jena, 1913.

at Ehringsdorf when a lucky shot threw out a human lower jaw; the same blast exposed fossil remains of deer, horse, ox, bear, and of Merck's rhinoceros. The stratum in which the human fossil jaw occurred lies 39 feet below the original surface of the quarry; another stratum, which is 8½ feet still deeper, yields implements of the Mousterian culture and charred wood derived from ancient hearths. The human jaw, like all fossil bones from the Ehringsdorf deposits, was soft and fragile when first exposed, but it dried and hardened without distortion. It was studied and described by the veteran anthropologist, Professor Gustav Schwalbe,[1] and after his death in 1917, was further investigated by Dr Hans Virchow,[2] son of the famous pathologist, who had the good fortune to have at his disposal when he prepared his monograph another specimen found in the same stratum in 1916—that of a child about ten years of age.

We have only two lower jaws and some teeth to tell us what kind of people lived at Taubach and Ehringsdorf in these far-distant days, and unfortunately neither mandible is complete. A comparison of the Ehringsdorf adult mandible with corresponding specimens of Neanderthal man leaves little doubt that it was part of a woman's face—a woman with a more prognathous ape-like face than is met with in later representatives of Neanderthal man. In fig. 67, the upper aspect of the Ehringsdorf mandible—the aspect on which the teeth are set—is contrasted with the corresponding view of a typical Neanderthal mandible—that of the Spy man No. 1. The framework of lines applied to these drawings is one contrived to fit the jaws and dentitions of modern Europeans. A line commencing in front, at the incisor teeth, is drawn backwards along the middle of the dental arcade; another line crosses the mid-line, 50 mm. behind the incisor teeth

[1] *Anat. Anzeiger*, 1914, vol. xlvii. p. 337. See also vol. xlix. p. 51, for a description of the teeth by Dr P. Adloff.

[2] *Die menschlichen Skeletreste ausdem Kampe'schen Bruch in Travertin von Ehringsdorf, bei Weimar*, Jena, 1920. The two fossil mandibles are preserved in the Weimar Museum.

(fig. 67). In the lower jaws of Englishmen the last or third pair of molar teeth usually fall in front of the 50 mm. line; if in English jaws the hinder borders of the last molars are joined by what may be called the "post-molar" line, this line will be found to fall, on the average, 48 mm. behind the incisor point. In the Ehringsdorf jaw the "post-molar" line falls 63 mm. behind the incisor point; in the Spy specimen 54 mm. On the other hand, the width of the Ehringsdorf dental arcade, as measured between the outer borders of the second pair

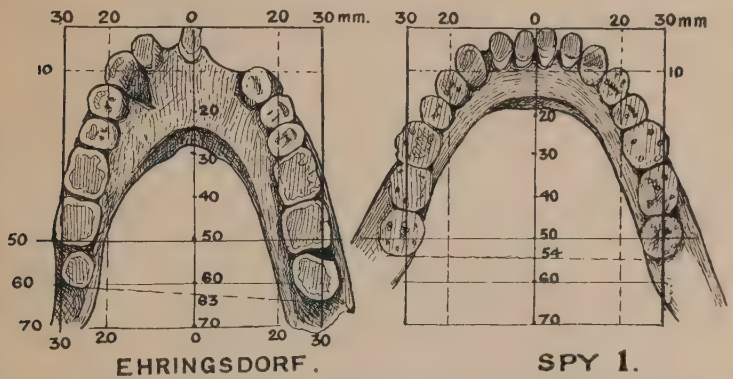

FIG. 67.—A drawing of the upper aspect and dental arcade of the Ehringsdorf mandible, contrasted with the corresponding aspect of the mandible of the Spy man No. 1.

of molar teeth, is relatively small—64 mm. or less. They project about 2 mm. beyond the lateral 30 mm. lines shown in fig. 67. This width is greater in the Spy specimen—68 mm., whereas in the average English jaw it is only 62 mm. We see, then, that in the course of evolution the teeth of Neanderthal man tended to become arranged in a short and wide arcade. In the Ehringsdorf race, a narrow and long palate, resembling that of the anthropoid ape, was still retained. Such a shape of jaw and palate indicates a prognathous face, the jaws having a muzzle-like projection.

There are two features of the dentition of this ancient woman of Ehringsdorf which arrest our attention. She

must, in her youth, have been the subject of a severe injury which knocked out the two right incisor teeth, and displaced the two on the left, for it will be seen that one of them has grown up in the middle line of the jaw (fig. 67), while the other leans towards the left canine. The crowns of all the teeth are ground down, and there are the marks of numerous abscesses or gumboils at their

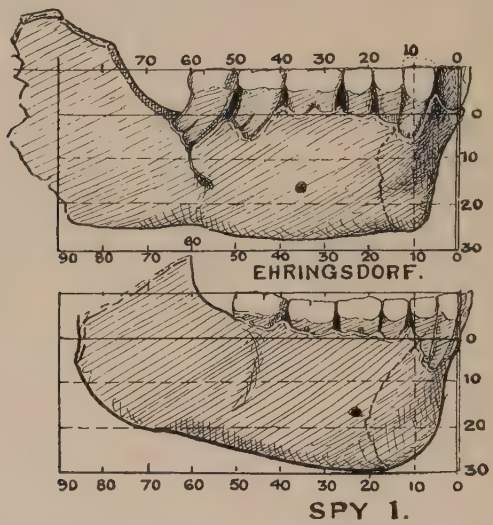

FIG. 68.—View of the profile of the Ehringsdorf mandible, as seen on its right side. (After Schwalbe.) A corresponding view is given of the mandible of Spy man No. 1. Both mandibles have been oriented on an alveolar plane—one passing parallel to the chewing surfaces of the teeth and cutting the alveolar margin at the roots of the middle incisor teeth.

roots. Further, it will be noted how small are the third molar or wisdom teeth—particularly the one on the left side. The small size, or reduced nature, of these teeth in nowise detracts from the antiquity which has been ascribed to the mandible. In many forms of apes—particularly in the chimpanzee—there is to be noted a definite tendency towards a reduction in the size of the third molar teeth—more especially in the upper jaw.

In fig. 68 there are represented true profiles of the Ehringsdorf and Spy mandibles. It will be observed how

stoutly the Spy mandible has been developed in the region of its chin and symphysis, much more so than in the more ancient Ehringsdorf specimen, and yet in this respect the latter is the more ape-like or simian. In both, as in all varieties or races of Neanderthal man, the tooth-carrying, or alveolar, part of the jaw projects far forwards —is prognathous—quite overshadowing and masking the region of the chin, which retains a retreating ape-like contour. An examination of the teeth leaves no doubt as to the Neanderthaloid affinities of the Taubach-Ehringsdorf people.

The second mandible, although that of a child of ten or eleven years of age, has, just as was the case in the child's skull at La Quina (see p. 177), the primitive Neanderthaloid features already emphasised. The ascending ramus of the jaw, which serves as a lever for the muscles of mastication, has a width of 34 mm. Although this child was only about ten years of age the ramus of its jaw was as wide as in most adult Englishmen.

The further discoveries of Neanderthal man in Europe need only a brief mention. In Moravia, within the northern outskirts of the watershed of the Danube, two discoveries have been made of Neanderthal man. In both cases only fragments of the lower jaw were found. They were found in the floor strata of a cave—one at Schipka and another at Ochos in 1906. The remaining discovery requiring our attention—one of the very first magnitude—takes us beyond the upper end of the Adriatic to Croatia, now a province of Yugo-Slavia, and right within the base of the Balkan peninsula. We owe the discovery to Professor Gorjanovic-Kramberger, a Professor in the University of Agram. In 1899, he commenced the exploration of a deposit, situated on a terrace on the side of a valley near the little town of Krapina, and through which the Krapinica flows—an early feeder of the Save. A section of the deposits exposed in his investigations is shown in fig. 69. He began his work at the end of 1899, and in 1906 was in a position to publish a splendid monograph embodying

his observations and conclusions. As will be seen from fig. 69, the deposits he explored on the side of the valley, 24 feet in depth, represent the accumulations on the floor of a rock-shelter which had been occupied by ancient man. On the original floor of the shelter lay a bed of gravel deposited when the Krapinica flowed flush

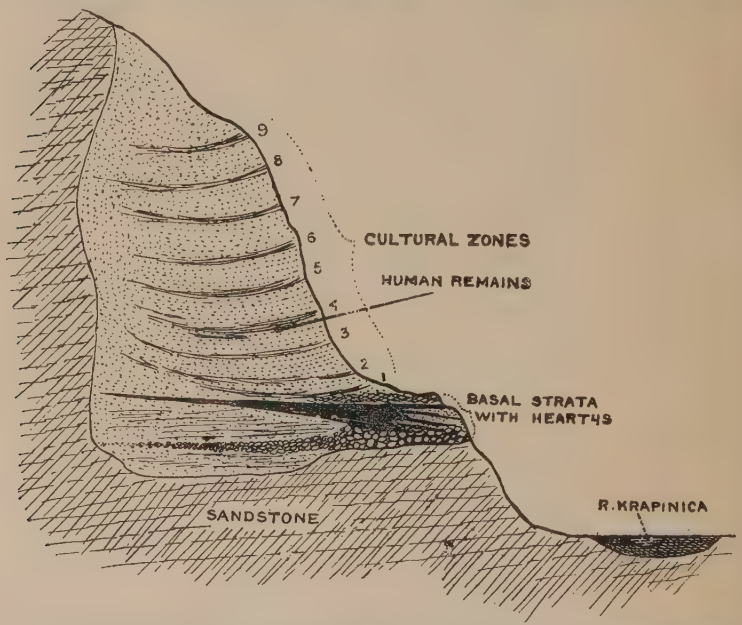

FIG. 69.—Section of the deposits in the rock-shelter at Krapina (Kramberger). The numbers 1 to 9 indicate the deposits formed during periods of human habitation.

with the floor of the cave—80 feet above its present level. The superimposed strata, showing nine different horizons marked by human occupation—hearths, tools, and débris of meals—proved to be the richest treasury of the Neanderthal race ever opened by the explorer's spade. Over two hundred fragments of human skeletons were found, representing at least ten individuals of all ages and both sexes. One hundred upper and one hundred and twenty lower human teeth were collected, all of them showing, in a varying degree, the characteristic form we

now associate with the Neanderthal race. Over two thousand fragments of bones of the animals of the period were found, including those of the same ancient form of rhinoceros as occurred at Taubach (*R. Mercki*). The cave-bear occurred abundantly; it was evidently a favourite article of diet. The rhinoceros bones had been broken open to extract their marrow. The mammoth and many other ancient and modern animals were also represented. Some of the human bones were charred, and some had been apparently split open: on this slender basis the Krapina men have been suspected of cannibalism. The implements, like those at Taubach, are not of the typical Mousterian forms, but experts ascribe them to the culture of that period. Some evidence, as at La Quina, was noted of bone having been shaped for use as a tool; perhaps wood was also worked.

Krapina was the first site to provide an opportunity for studying the children and the youth of this strange species of man. As is well known, there is a close superficial resemblance between the skulls of man and anthropoid ape during infancy and childhood. The brutal and distinguishing features appear on the ape's skull during the years of growth; the human skull during that period changes to a less degree. Hence it is not surprising to observe that the children at Krapina are, in the form of head and face, more like men of the modern type than is the case with their parents. The great simian eyebrow ridges do not assume their massive size and characteristic Neanderthal form until the later years of adolescence are reached. The skulls of the women retain the cranial features of the young to a greater degree than is the case with the male sex. Hence the Neanderthal women were less distinctly marked off from the modern type of mankind than was the case with the men. Indeed, to account for the variety of forms found at Krapina, Professor Klaatsch has suggested that some of the individuals may represent captives which Neanderthal people had made from their enemies—the contemporary representatives of *Homo sapiens*. Professor Kramberger is of

opinion that, amongst the individuals he discovered, there are some which bridge the gap between these two types of man—the Neanderthal and the modern. The writer has observed no fact which supports such an opinion; the closer the records from Krapina are studied, the more one becomes convinced that there are no intermediate nor hybrid individuals represented. The skulls are fragmentary; not one is complete. Yet they are sufficiently perfect to show that they carry all the marks of the Neanderthal race. Further, as we saw from the Gibraltar skull, these Krapina people give us the most certain assurance that the Neanderthal species of man, like the modern species (*Homo sapiens*), was separated into distinct races. The Krapina and Gibraltar races differed from their contemporaries in France, Belgium, and Germany. As in modern races, there were, in the Neanderthal species, both long-headed and round-headed races. The skull from the Neanderthal cave is a sample of the long-headed race; those of the Krapina people represent a short-headed variety; the Gibraltar skull belongs to an intermediate group.

Thus we see that, in the Mousterian period, in the middle Pleistocene age, when the middle or 50-foot terrace was being laid down in the Thames valley, Europe was inhabited by a peculiar species of mankind—of quite a different type from the races which now populate it. This race spread from Gibraltar in the south to Weimar in the north, from Croatia in the east to Jersey in the west. The culture of this period has been found both in Italy and in England. In neither of these countries, however, has any fossil trace of Neanderthal man been found so far. The future may make good that blank, for we see no reason why he should not have occupied both of these countries as well as Central Europe.

The most marvellous aspect of the problem raised by the recognition of Neanderthal man as a distinct type is his apparently sudden disappearance. He is replaced, with the dawn of the Aurignacian period, by

men of the same type as now occupy Europe. What happened at the end of the Mousterian period we can only guess, but those who observe the fate of the aboriginal races of America and of Australia will have no difficulty in accounting for the disappearance of *Homo neanderthalensis*. A more virile form extinguished him. He suddenly appears in Europe—from whence, future investigations may disclose; the one thing we are now certain of is that he was not suddenly converted into the modern type of man.

Before bringing this chapter to a close, mention must be made of an event which has an important bearing on the history of Neanderthal man. In the autumn of 1917, Dr G. Despott, curator of the Museum of Natural History, Malta, while excavating a vast cave in the south-eastern corner of the island (Ghar Dalam), came across unmistakable traces of this strange species of man. This discovery, and the one made at Gibraltar almost seventy years before, carries the distribution of the Neanderthal type to the threshold of Africa. His recognition in Malta has a particular significance because that island is a remnant of the great land bridge which at a certain phase of the Pleistocene period united Italy to Tunis, and permitted a free exchange of living things between two continents. We shall see in another chapter (XVIII) that traces of a Mousterian culture—the culture practised in Europe by Neanderthal man—occur in various parts of Northern Africa, and that there has been found, far to the south of the Equator, fossil remains of a species of man who was of near kin to the species we have just been studying in Europe. All of these matters will be discussed when we come to search Africa for evidences of man's antiquity. Meantime we must make an examination of the structural characters of Neanderthal man and see wherein he differed from all living races.

CHAPTER X

THE ANATOMICAL PECULIARITIES OF NEANDERTHAL MAN

In the two preceding chapters attention has been concentrated on the various sites and dates at which the remains of Neanderthal man have been found, and on the varying place which has been assigned to him by anthropologists. We have seen him regarded as the product of disease, of Nature in a freakish mood, as an ancestral form of man, representing the stage mankind passed through during the Pleistocene period, as an extreme variant of modern man which had retained an undue proportion of simian or ape-like characteristics. Then we reached our present concept of him as a separate and peculiar species of man, which died out during, or soon after, the Mousterian period. All the time we have been talking round him, as it were, never attempting to lay bare or analyse those features which mark him off from all the modern races and varieties of mankind, and give him, in the eye of the anthropologist, an altogether novel and peculiar position.

To make the structural differences between the Neanderthal and modern species of mankind clear, we cannot do better than select those two Pleistocene skulls found in the region of the Dordogne—the one at Combe Capelle representing the modern type (p. 165), and the other from La Chapelle-aux-Saints, the Neanderthal type (p. 172). In the instances chosen, the Neanderthal is the larger in all dimensions, save one. It is the more capacious, having the larger brain capacity ; it is longer and wider, but it is not so high ; its vault is peculiarly low.

The depression of the vault is even more marked when the Combe Capelle skull is set side by side with the one from

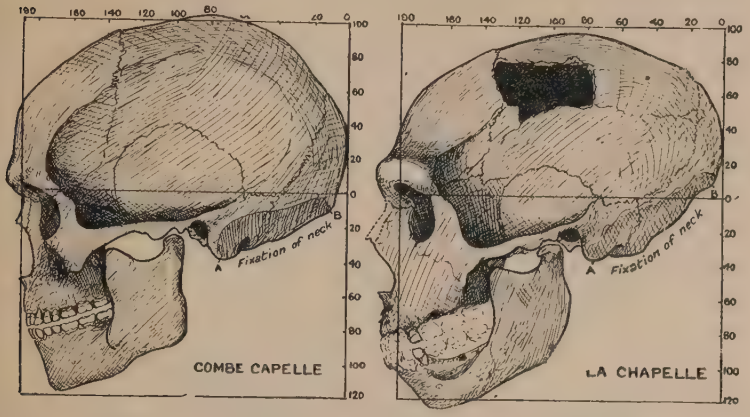

FIG. 70.—Skulls of the modern type (Combe Capelle) and of the Neanderthal type (La Chapelle) contrasted on their lateral aspects.

Gibraltar. The first rises above the upper limit in the conventional linear frame; the second falls far short

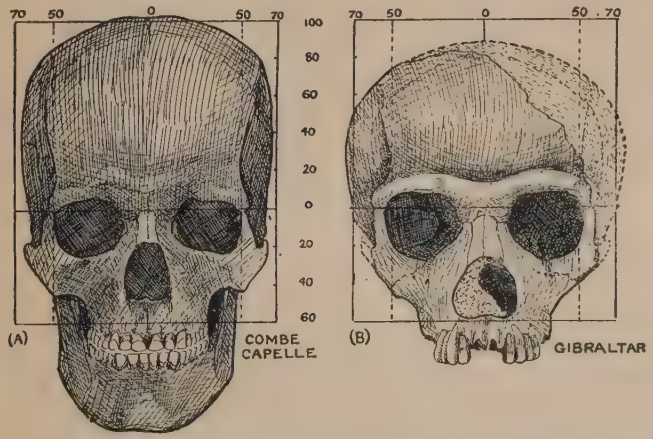

FIG. 71.—A skull of the modern type (Combe Capelle) contrasted with one of the Neanderthal type (Gibraltar) as seen in full face.

(fig. 71). The Neanderthal skull gives us the impression of being compressed from above downwards into

a bun-like form; the modern skull is flattened in an opposite direction, from side to side. All Neanderthal skulls show this peculiarly depressed platycephalic form —especially apparent in the hinder or occipital region—a feature which must have given Neanderthal man in life the peculiar appearance of having the hinder part of his head buried, apparently, in a thick, bull-like neck (see fig. 79). It is true that in certain modern varieties of mankind—as in a strain which still occurs in Holland, in England, and has been also found in ancient graves in America [1]—the skull is low-domed or platycephalic, but the resemblance to the Neanderthal type is only superficial. To find a counterpart of the platycephalism of Neanderthal skulls we have to go outside the limits of human species to the skulls of such anthropoids as the gorilla and chimpanzee. The functional meaning of this peculiar form of skull, found in anthropoids and in the Neanderthal species of man, will be discussed at a later stage in this chapter (see p. 217). Meantime we simply note the fact that the general form of the brain is modified to suit the skull in which that brain is contained. Hence, although the brain of Neanderthal man equals or exceeds that of the modern type of man in point of size, yet in its general conformation it resembles the brain casts taken from anthropoid skulls.

The kind of skull, just described, reveals a radical difference in head-formation, and can be readily recognised in a museum or laboratory. But let us suppose we are back in the world of Pleistocene man and are brought face to face with Neanderthal man in life—which of his features would force themselves on our attention as distinctive marks? The colour of the skin, the texture of the hair, the cast of countenance, the play of eye and lips which distinguish at a glance the better-marked varieties of modern mankind—the African, the Mongolian, the European—are not available, for we have only, as regards fossil forms of man, the limited range of characters revealed by the dry bones of the face and

[1] See reference, p. 460.

limbs. We feel assured, however, that certain features of the face would have at once struck us as totally different from anything seen on the countenance of modern man. To find eyebrow ridges like those of Neanderthal man,

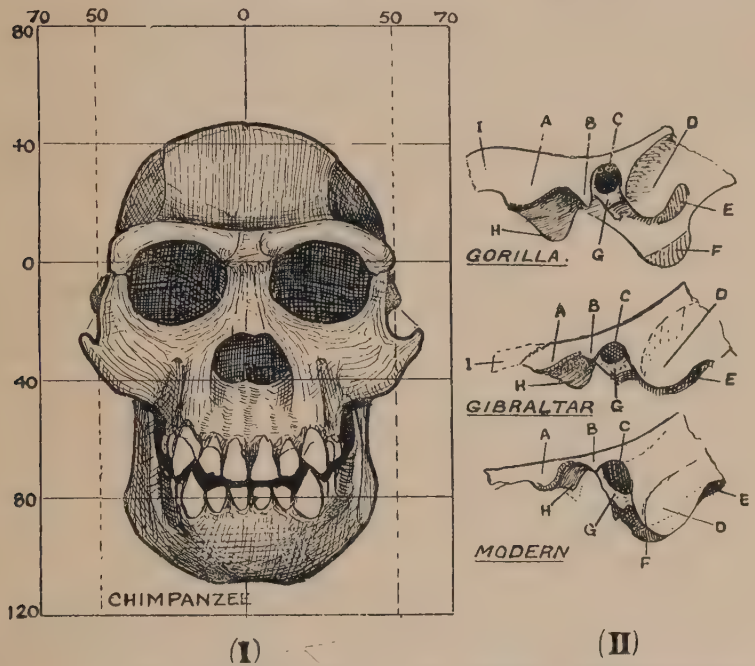

FIG. 72.—I. The supra-orbital ridge or torus and other features of the face of a male chimpanzee. II. The form of articular cavity for the lower jaw in the Gibraltar skull, contrasted with the forms in the gorilla and modern man.

A. Articular eminence.
B. Post-glenoid spine.
C. Meatus of ear.
D. Mastoid process.
E. Digastric fossa.
F. Occipital condyle.
G. Tympanic plate.
H. Mesial part of articular eminence.

great continuous horizontal bars of bone, overshadowing the orbits—a supra-orbital torus—we have again to refer to the anthropoid skull. In the skull of the chimpanzee (fig. 72) and of the gorilla we see the same development of the forehead and supra-orbital region. In modern races the supra-orbital ridges vary enormously in form and in degree, but they never assume the anthropoid

or Neanderthal form. Their usual development is that shown in fig. 71 (Combe Capelle). The supra-nasal or middle part of the ridge is quite distinguishable from the lateral or temporal part. No doubt these ridges tend to become less developed in civilised races. There is also no doubt that the supra-orbital ridge or torus is part of a bony scaffolding erected on the face and skull to serve the purposes of mastication. The outer or temporal projection of each supra-orbital ridge gives attachment to the chief muscle of mastication—the temporal. The upper jaw sends upwards, between the eyes, supporting processes to transmit strains from the palate to the supra-orbital bar (see fig. 71). On the outer side of each orbit, the cheek or malar bone also reaches up to the supra-orbital bar, transferring to it the strains and stresses caused by another muscle of mastication—the masseter—which rises from the cheek bone and from the zygomatic arch. A fuller knowledge of the mechanism of mastication is likely to throw light on the nature of the various shapes and types assumed by the supra-orbital ridges. Meantime we simply note the fact that Neanderthal man had eyebrow ridges of the anthropoid type.

We have just seen that in general form of cranial cavity and of supra-orbital ridge, Neanderthal man resembles anthropoid apes, while, in these features, the modern type of man differs from them. Are we, then, to conclude that Neanderthal man is directly related to, is a direct descendant of, an anthropoid form, while modern man is not? I do not think so. We must take into account the condition of the supra-orbital ridges in all anthropoid apes. In the Malayan orang, which is a distant cousin to the African anthropoids—the gorilla and chimpanzee—the supra-orbital ridges do not form a prominent torus. When the outlines of the skull of a chimpanzee and orang are superimposed, as in fig. 73, some light is thrown on the cause of their great development in the former and slight size in the latter. In the orang the face is turned more upwards, and holds such a

relationship to the whole skull that the strains and stresses arising during mastication are transmitted, not to the forehead, as in the chimpanzee, but to the skull as a whole. There is no need in the orang for a frontal scaffolding of bone. The retrogression of the supra-orbital ridges in the orang is apparently secondary. The gorilla and chimpanzee appear to retain the original form—the form found in the oldest and most primitive of anthropoid

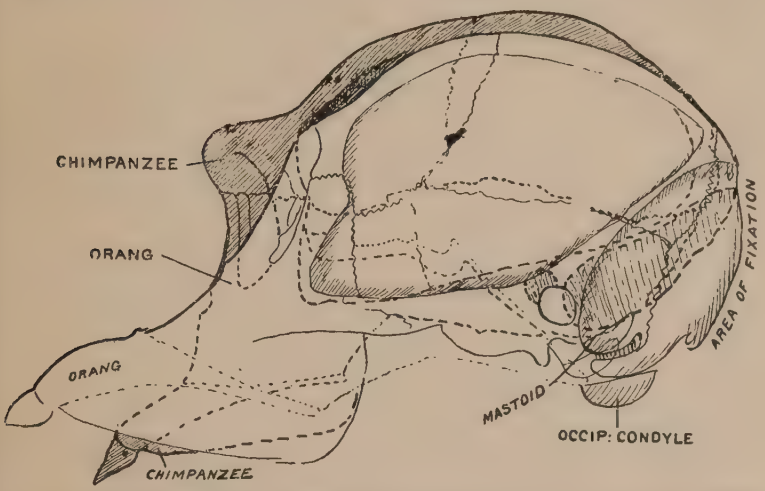

FIG. 73.—The skull of an orang superimposed on that of a chimpanzee to show the presence of a torus supra-orbitalis in the latter.

apes, the gibbon. On the other hand, the divided or bipartite condition of the supra-orbital ridge seen in modern human races (fig. 71) is also met with amongst old-world monkeys.[1] If we suppose that the old-world monkeys are still more ancient and primitive than the anthropoids, then it might be argued that it is modern man that has retained the primitive or original form of supra-orbital ridge, and that the bony torus, seen in the gorilla, chimpanzee, and Neanderthal man, has been evolved at a more recent date.

[1] D. J. Cunningham, "The Evolution of the Eyebrow Region of the Forehead," *Trans. Roy. Soc. Edin.*, 1908, vol. xlvi. p. 283.

I am discussing at some length the development of the supra-orbital ridges, because we could not cite a better instance of the kind of evidence we have to use in tracing the genealogy of man. We might explain the torus-like ridge in Neanderthal man by supposing him to have arisen from a gorilla-like stock, and modern man from a monkey-like ancestry. That would explain why modern man has a forehead of one form and Neanderthal man a forehead of quite another type. We should thus fall back, as Professor Klaatsch [1] did, on the theory that mankind is multiple in origin—that one human race has been evolved from one ancient stock of primates, while another race has arisen from another and quite different simian stock. But in successfully explaining this one and minor feature we should find, if we accept a "polyphyletic theory" of man's origin, that the great majority of structural relationships were not capable of being thus explained. We must take all the characters of the human body into consideration, not one or more isolated features, and when we do this it is plain that the Neanderthal type and the modern type of man share the great and exceedingly complex inheritance which is common to the human family. We must suppose that this community of structure is due to a community of origin—to the fact that they have a common ancestry. Further, when we begin to analyse the structural nature of man and his nearest allies—the gorilla, chimpanzee, and orang—we find he shares so much with them, much more than with old-world or new-world monkeys, that, to explain the widespread community of structure, we are compelled to suppose the great anthropoids and all human forms, living and fossil, to have arisen from a common stock (see Frontispiece). Now in that common stock from which anthropoids and men have been evolved we have reason to believe that the supra-orbital ridge was of the torus type. In the ancestry of modern races it has been modified. Indeed, in many living peoples there is a tendency to assume the condition seen in fœtal or infantile

[1] See *Nature*, 1911, vol. lxxxv. p. 508.

stages, where those ridges are still undeveloped. In Neanderthal man, on the other hand, the torus form of supra-orbital ridge and the platycephalic shape of cranium of the simian ancestor have been retained.

The great majority of those structural features which mark Neanderthal species off from modern races are essentially of a simian or anthropoid nature. For instance, when the circumnasal region of the Neanderthal face is examined (fig. 71) it will be seen to have the inflated or blown-out appearance to be observed in the gorilla or chimpanzee (fig. 72), differing materially from the collapsed or deflated condition seen in the face of the existing or modern types of mankind.

We are surprised to note, however, that one simian feature is absent from the nasal region of the Neanderthal skull. In the chimpanzee's skull (fig. 72) the side margin of the bony nasal aperture descends towards the teeth, bounding a groove or gutter on the floor of the entrance to the nasal cavity. These nasal grooves or gutters are also present in the skull of many primitive modern races —an anthropoid or simian condition. The simian nasal gutter is present in the Combe Capelle skull to a slight degree, but not a trace of it is present in the Gibraltar skull. There, as in the most highly evolved of modern skulls, the lateral margins of the nose turn inwards to the nasal spine, forming a sharp lower margin at the entrance to the nose (fig. 71). The simian nasal gutter is a character to be ascribed to the modern type of man rather than to the Neanderthal type, although in the latter it may, as in the specimen from La Chapelle-aux-Saints, have some degree of representation.

From the time of the discovery of the Naulette jaw in 1866 it has been recognised that the Neanderthal species has certain peculiar markings or characters of the chin which have been already touched on in connection with the Ehringsdorf jaw (p. 192). In a later chapter (see p. 521) it will be necessary to describe in some detail the exact manner in which certain muscles of the tongue —muscles which play an important rôle in articulate

speech—make an attachment to the hinder or lingual aspect of the mandible in the region of the chin and symphysis of the lower jaw. At the present stage it will be enough to refer the reader to the diagrams given in fig. 74, which represent sections made at the middle line or symphysis of the lower jaw. The first figure represents a vertical section of the chin region of a very young gorilla—under two years of age. The upper or alveolar border, on which the incisor teeth are implanted, projects well in front of the lower border. Strictly speaking, there is no chin—at least no eminence at the lower

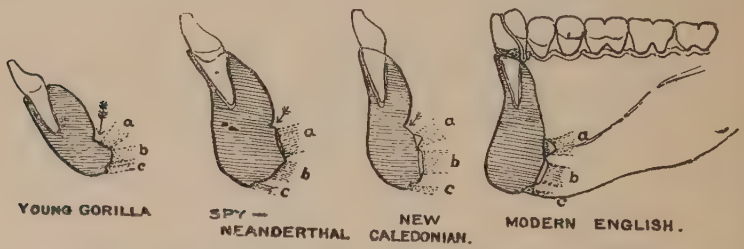

FIG. 74.—Sections of the lower jaw at the middle line or symphysis of a young gorilla, of a man of the Neanderthal type (Spy), of a native of New Caledonia, and of a modern Englishman.

a, attachment of the genio-glossal muscle; *b*, of the genio-hyoid muscle; *c*, of the digastric muscle. The arrow points to the genial pit.

border. On the hinder aspect of the symphysis (indicated by an arrow in fig. 74) there is a pit—the "genial" pit. From the lower part of this pit arise the two chief muscles of the tongue—the right and left genio-glossal muscles (*a*, fig. 74). Beneath these muscles is a linear impression for another pair of muscles, also concerned in the movements of the tongue, the genio-hyoid muscles (*b*). Below the linear impression and on the lower border or aspect of the chin region another pair of shallow impressions in the bone marks the attachment of the digastric muscles which can depress the jaw and help to open the mouth (*c*, fig. 74). The second section in fig. 74 represents the same parts in a Neanderthal mandible—one found at Spy. The upper or alveolar border is still the more

anterior or projecting; the lower border and the region of the chin recede. There is no chin eminence. On the hinder aspect the genial pit is almost filled up, but there is still a remnant to be seen (fig. 74). The muscles of the tongue arise from areas corresponding to those in the gorilla (*a*, *b*, *c*). The next section in fig. 74 shows the region of the chin in a representative of a modern primitive race—a native of New Caledonia, in the Pacific Archipelago. The upper and lower borders of the lower jaw are nearly equally prominent; indeed, the chin eminence is slightly developed. On the posterior aspect of this particular mandible there is a trace of the genial pit—a simian trait; but there are also present below the pit special minute projections of bone—tubercles or spines from which the special muscles of the tongue arise (see fig. 74, *a*, *b*). Those tubercles or spines are absent in mandibles of the Neanderthal type. Lastly, the region of the chin of a modern European is shown. The lower border is the more prominent; there is here a well-developed chin eminence. On the posterior aspect there is no trace of the genial pit; the genio-glossal muscles (*a*) arise from two projecting points or spines of bone.

We cannot account satisfactorily for the various structural features exhibited by the series of specimens just described unless we suppose the simian to be the ancestral form, and the others—the Neanderthal and the modern—to represent modifications of the simian type. There can be no doubt that, in the region of the chin, Neanderthal man retains a simian condition to a greater extent than does the modern type of man. When we seek to explain these changes on a functional or physiological basis we proceed on the belief that they have been brought about by the interaction of at least two factors. In the first place, the teeth have become smaller; retrogression in the size of the teeth leads to the front or incisor teeth receding in the mouth, leaving the nose above and the chin below more prominent. Undoubtedly another process has been at work. The lower border of

the mandible, in the region of the chin as well as in the region of the cheek, bounds the floor of the mouth. In order to secure free movement of the tongue and easy, articulate speech, it is highly advantageous to have the floor of the mouth opened out. In anthropoids the lower border of the mandible encroaches on, and diminishes the area of, the floor of the mouth. In the most highly evolved forms of men the lower border of the mandible is widened or opened out (see fig. 241, p. 657). In Neanderthal man the expansion of the lower border of

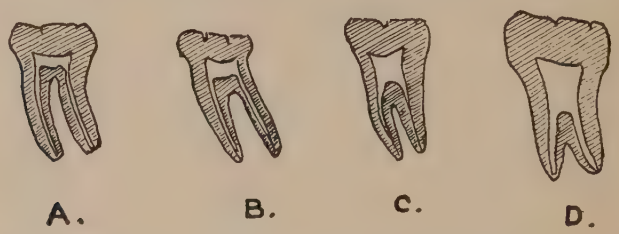

FIG. 75.—Four lower molars, as seen when examined by X-rays.

A. Of a chimpanzee.
B. Of a modern European.
C. A tooth found at Taubach (Adloff).
D. Of a Krapina individual.

the mandible is less complete than in man of the modern type.

It is when we come to study the teeth of Neanderthal man that we first obtain a real clue to his position among the ancestral forms of modern man. In 1907, Professor Adloff, then in Königsberg, published a very important series of conclusions he had reached from a study of the teeth found by Professor Kramberger at Krapina.[1] What he found is shown in a brief and diagrammatic manner in fig. 75. In that figure, A represents the lower molar of a chimpanzee, as seen when examined by X-ray transillumination. The pulp cavity, in the body or crown of the tooth, is small; the fangs, containing extensions of the pulp cavity, as far as their tips, are long. The lower molar of a modern European—a man of the

[1] "Die Zähne des *Homo primigenius* von Krapina," *Anat. Anz.*, 1907, vol. xxxi. p. 273. See also *Das Gebiss des Menschen und der Anthropomorphen*, Berlin, 1908. Also see reference, p. 682.

modern type (fig. 75, B)—shows a similar form of pulp cavity and of roots. In Neanderthal man the pulp cavity attained remarkable dimensions (fig. 75, D); the cavity has extended downwards at the expense of the roots, which accordingly become very short. The molar teeth are large in crown and body and exceedingly short in root. In C (fig. 75) the lower molar found at Taubach (see p. 191) is represented. It has the Neanderthal characters. To this peculiar form of molar tooth which became evolved in Neanderthal man I have proposed the name of "taurodont," because in general form there is a resemblance to the molar teeth of the ox.[1] To the more primitive form, seen in apes and also in modern types of men, the name "cynodont" is given, because there is a superficial resemblance to the molars of a dog. We must admit, then, that in character of teeth Neanderthal man had departed widely from the primitive or simian type, while races of the modern type have retained the older or more simian type of molar tooth. In short, with all his primitive or simian features, there are certain structural modifications in which Neanderthal man shows a greater degree of specialisation than is to be seen in any race of living man. How did Neanderthal man come by these strangely shaped molar teeth? Here we touch upon one of the most difficult problems presented to the student of living things: How do new features arise? As regards teeth, we must seek for guidance by watching the manner in which they are formed. The reader will quickly understand the clue to the present problem by examining the two series of drawings, an upper and a lower, represented in fig. 76. In the upper series we see stages leading on to the formation of the second upper molar of a modern man; in the lower series, the corresponding stages which lead on to the taurodont molar of Neanderthal man—the specimen illustrated being a second molar tooth found in the Ghar Dalam Cave, Malta. The early stage (A) in both series is the same,

[1] See "Problems relating to the Teeth of the Earlier Forms of Prehistoric Man," *Proc. Roy. Soc. of Med.*, 1913, vol. vi. (Odont. Sect.), p.1.

the cusps and chewing surface of the crown are formed; in the second stage (B) the side walls of the pulp cavity are being formed; the floor for this cavity has appeared in the upper but is still absent in the Neanderthal series. In the next stage (C) the roots are being formed in the upper, but there is no appearance of either floor

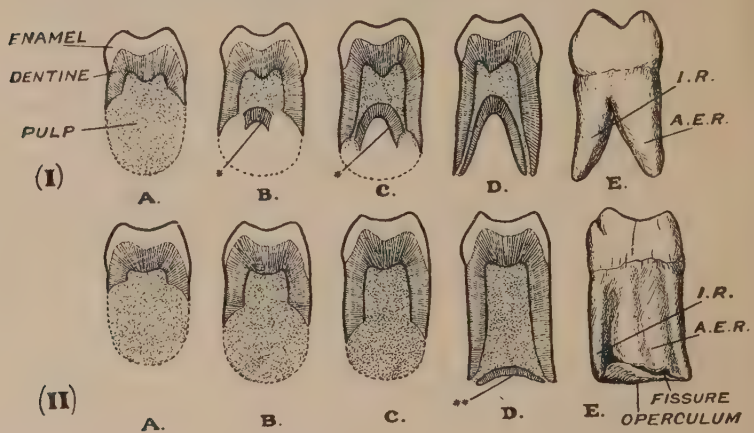

FIG. 76.—Two series of drawings, the upper to illustrate stages in the development of the primitive type of molar retained by modern man; the lower, corresponding stages leading on to the specialised form of molar found in Neanderthal man.

E (I), The second upper right molar of a modern European seen on its anterior or medial aspect.

E (II), The corresponding aspect of the same tooth of Neanderthal man; the tooth represented was found in the Ghar Dalam Cave, Malta.

I.R., Inner root; A.E.R., anterior external root.

*, Floor of pulp cavity; **, operculum.

or separated roots in the corresponding stage of the lower. In the final stage (D) the roots are finished in the upper series, while in the lower the floor of the pulp cavity has at last appeared and thus completes the formation of the tooth. No separated roots are formed in this extreme example of a taurodont tooth; the floor of the pulp cavity forms a lid or "operculum" at the end of a single swollen root. This new form of tooth has been produced in the simplest manner possible—simply by delaying the formation of the floor

of the pulp cavity from stage B to stage D. We shall see that new characters are often formed in the human body by altering dates of development.

In the palate, as well as in the teeth, there is evidence of specialisation. The only skull in which the palate

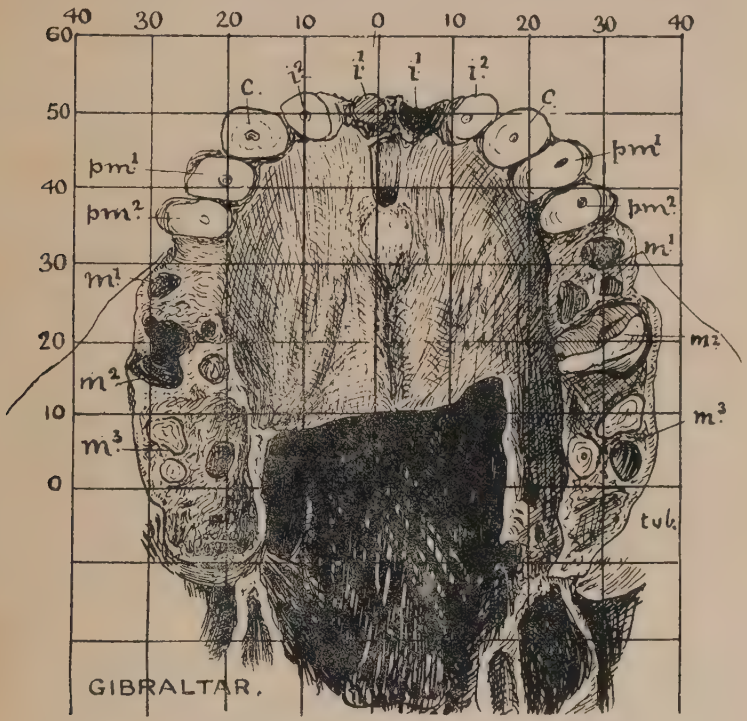

FIG. 77.—Drawing of the palate of the Gibraltar skull.

has been preserved nearly intact is that found at Gibraltar; a careful drawing showing the exact dimensions and state of that palate is reproduced in fig. 77. It is at once seen, not only to be larger than the palate of modern man, but also different in shape. Its distinguishing feature is its great width, as compared with its length. The primitive form of the palate—that seen in anthropoid apes—is one with approximately parallel sides, on which the molar and premolar teeth are set (see fig. 182, p. 526). In the figure

cited the palate of a female chimpanzee is represented. The width, measured between the outer margins of the second molar teeth, is 58 mm.; its length, represented by a line drawn from between the crowns of the middle incisor teeth to a point situated at the middle of a line joining the hinder borders of the last molar teeth (see fig. 78), is 70 mm. The palate is long and narrow, the width being 80 per cent. of the length. In fig. 78 the outline of the palate of the Gibraltar skull is reproduced side by side with the palate of a native Tasmanian—the

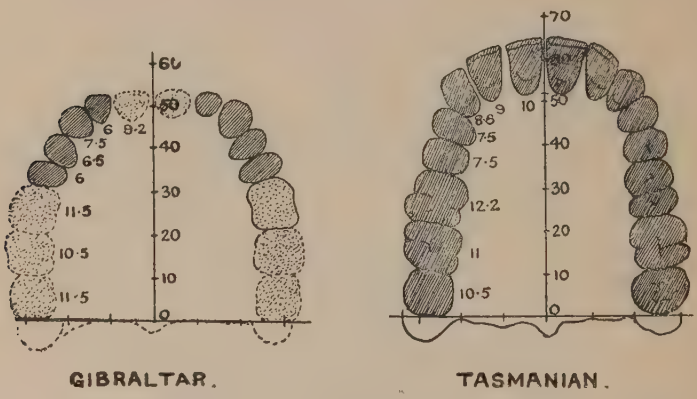

FIG. 78.—Outlines of the palate of the Gibraltar skull, and of a skull of a native Tasmanian, showing a contrast in shape.

latter serving as a representative of a primitive type of modern man. It is at once seen that the Tasmanian is the more simian in form of palate. Its length is 65 mm., its width, 70 mm., the width representing 107 per cent. of the length. In the Gibraltar skull the length is much less, 54 mm., the width rather greater, 71 mm., representing 131 per cent. of the length. Although the La Chapelle man had lost most of his teeth from disease, one may estimate that the width of his dental arcade at the second molars must have been about 74 mm., and its length about 64 mm. The width proportion was thus about 115 per cent. We have already seen (p. 193) that the Ehringsdorf woman retained the simian form of

dental arcade. We thus see that not only the teeth but also the palate of Neanderthal man had departed more widely from the simian type—had undergone a greater degree of specialisation—than the palate and teeth of races of the modern type. What was the meaning—the functional significance—of such a specialisation? The Neanderthal teeth, in the writer's opinion, are of the type seen in herbivorous mammals. The wide palate, the wide dental crowns and big bodies of the teeth seem to indicate powerful side-to-side grinding movements of the mandible during mastication. On the evidence of the teeth and palate one is inclined to regard Neanderthal man as specially adapted to live on a rough vegetable diet.

In the evolution of the early ancestral form of man from an anthropoid type, the palate, jaws, teeth, and other parts concerned in mastication appear to have undergone retrogression, as the brain became a larger and more efficient organ. The brain, by its invention, saved the labour of the jaws. The area of the palate (see p. 658) may be taken as an index of the extent to which the masticatory system is developed. The capacity of the cranial cavity of the skull serves as a rough index of the brain power. It will be of interest to inquire how Neanderthal man stands in respect of palate and brain development. The area of the Gibraltar palate is 31·60 cm.^{2}; the brain capacity, 1200 c.c. The ratio of brain to palate is 38 c.c. of brain to 1 cm.^{2} of palate. The corresponding area of the palate of the La Chapelle man is calculated to have been 39·00 cm.^{2} The brain capacity of the La Chapelle individual being about 1620 c.c., the brain-palate ratio is 41·8 : 1, a higher brain ratio than in the Gibraltar skull. Among anthropoid apes, selecting a female chimpanzee as the most favourable example for the purpose of comparison, the brain capacity is found to be about 350 c.c.; the area of the palate, 36·50 cm.^{2}; the brain-palate ratio, 8·7 : 1—a small brain and a large palate. The female chimpanzee and the La Chapelle man have palates, although very different in shape, almost of the same size. The brain of the chimpanzee, on the other

hand, is only a quarter or one-fifth of the La Chapelle brain. Taking now a very primitive example of modern man, the skull of a native Tasmanian, in the museum of the Royal College of Surgeons, England, we find the brain capacity to be 1350 c.c.; the palate, 36·70 cm.^{2}; the brain-palate ratio, 36·7 : 1. The palate, in comparison with the brain, is larger than in the two Neanderthal specimens just cited. In the Aurignacian man from Combe Capelle the area of the palate is approximately 27·1 cm.^{2}; the brain capacity, 1440 c.c.; the brain-palate ratio, 53·3 : 1—a ratio which holds true in a large proportion of modern races. In the average Englishman the brain capacity is 1480 c.c., the area of palate 25 cm.^{2}; the brain-palate ratio being 59 : 1. The palates of Neanderthal men were absolutely and relatively large, yet the ratio between brain and palate falls within the limits of variation seen amongst existing primitive races.

In fig. 72 (p. 203) another peculiar feature of Neanderthal man is represented. The socket or cavity, in which the condyles of the lower jaw are jointed to the base of the skull, just in front of the ear passages, is depicted in the form seen in the gorilla, in the Gibraltar skull, and in a man of the modern type. In the gorilla the socket is very shallow, and is placed on a platform or thickening of bone at the root of the zygomatic arch—the articular surface lying almost flush with the lower border or floor of the ear passage (fig. 72). In men of the modern type the hinder part of the socket—the glenoid fossa—is deep, being excavated to the depth of the roof of the ear passage. The front part of the articular platform has become developed as in the gorilla, forming an articular eminence in front of the socket. It is only the hinder or pre-auricular part of the anthropoid articular platform which remains undeveloped, giving rise to the well-known socket for the jaw—the glenoid cavity. When the Gibraltar skull—representing the Neanderthal type—is examined, this joint is found to resemble that of the anthropoid rather than that of modern man. In this region of the skull Neanderthal man shows distinctly

simian traits. So, too, in the passage of the ear. The plate of bone which forms the floor of the passage—the tympanic plate—is shaped in Neanderthal man as in the gorilla. In the modern type of man it has come to form the posterior slanting boundary for the glenoid cavity or mandibular socket (fig. 72, II.).

In the auricular region of the skulls of Neanderthal men there is another simian feature to which attention may be directed, although it is not concerned in the function of mastication. In skulls of the modern type a pyramidal-shaped process of bone—the mastoid process—descends immediately behind the ear. To this process certain muscles of the neck, concerned in moving the head, are attached (see fig. 79). It is only slightly developed at birth, attaining its full size when the individual has reached adult years. In the gorilla a mastoid process is present, but in place of growing downwards to form a pyramidal process, it expands into a flange-like plate, forming part of the bony occipital platform on which the muscles of the neck are implanted (see fig. 72, II.). The pit or fossa from which the digastric muscle arises is thus left exposed on the anthropoid skull below the mastoid process. In skulls of the modern type the pyramidal process covers and hides the digastric fossa (fig. 72). In Neanderthal skulls the mastoid process does not assume a distinct pyramidal form ; in its shape and relations it is intermediate to the form seen in young anthropoids and that which occurs in men of the modern type. It will thus be seen that in the mastoid region Neanderthal skulls show a series of characters which may justly be regarded as simian in nature and origin.

Mention has already been made of the flattened platycephalic skull of anthropoids and of Neanderthal man. It is now necessary to look somewhat more closely into the nature of this character. In fig. 79 the poise of the head in the modern type of man and in the Neanderthal type are contrasted. In the Neanderthal poise one has the impression that the occipital region of the head was partly buried in the neck, owing to the head being tilted

or extended backwards. To some degree this is true; the head was carried in a more extended or retroflexed position, for it will be observed that the muscles of the neck have attained a more extensive attachment to the occipital region than in the contrasted type. In Neanderthal man the muscles of the neck ascend above the posterior end of the lateral blood sinus (see fig. 79, L.S.); in modern men the muscles of the neck are usually

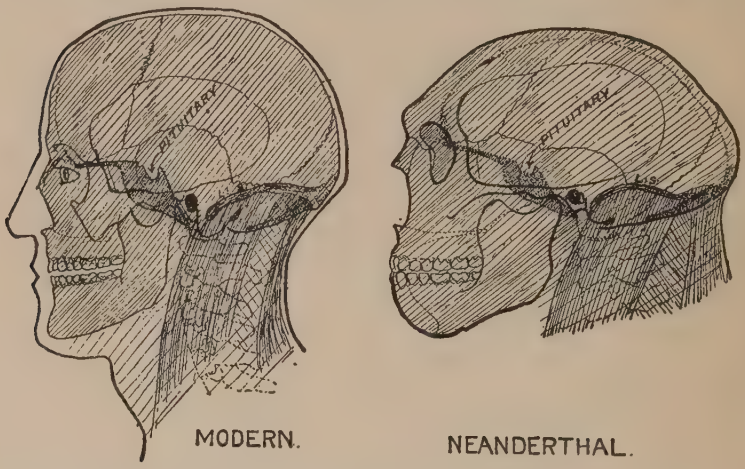

FIG. 79.—Diagram showing the poise of the head in the modern and Neanderthal types of man. The Gibraltar skull was used as the basis of the drawing of the Neanderthal type, a lower jaw being modelled from one of the mandibles found at Spy.

attached short of this point. Indeed, the head is fixed to the neck in the Neanderthal race in much the same manner as in young anthropoid apes. We have just seen that the mastoid process, which must be counted part of the skull which gives attachment to the neck, is also partially simian in character.

It seems to me very probable that this peculiar poise of the Neanderthal head is related to the great development of the face and jaws. If the illustrations in fig. 79 be examined it will be seen that the hinder border of the lower jaw lies just in front of the spinal column. If the reader will let the head fall forwards on the front of the

neck, it will be found difficult to move the jaw, as in chewing, because it is wedged behind against the backbone. But if the face be thrown upwards—the occiput, of course, sinking backwards and downwards at the same time—it will then be found that the mandible has room for the most ample movements. It is for a similar reason, apparently, that Neanderthal man's head was fixed in an extended pose—one which gave his lower jaw room to move.

There is another modification in the basal part of the skull which tends to throw the face forwards and thus give freedom to the lower jaw. In 1863, Huxley [1] called attention to the manner in which the base or axis of the skull had become bent during the evolution of the higher primates. The greatest amount of bending is seen in modern human skulls. Now, in the illustrations given in fig. 79, the basal axis of the skull is represented by a stippled outline. The pit or fossa for the small pituitary body or gland is situated on the upper (intracranial) aspect of the basal axis. The part of the base behind the pituitary—the *postpituitary* part—slants downwards and backwards, lying over the pharynx; the part in front—the *prepituitary* part—stretches horizontally forwards, towards the root of the nose. In ordinary monkeys the prepituitary and postpituitary parts form an almost straight line—there is little or no bending. In anthropoids the bending becomes apparent. In fig. 80 the degree of bending at the pituitary angle in a gorilla is represented; it amounts to 142°. Some years ago Professor G. L. Sera [2] drew attention to the fact that this angle is very open in the Gibraltar skull—the only Neanderthal specimen in which the base is preserved. The angle is almost as great as in the gorilla, 140° (fig. 80). In skulls of the modern type it varies from 120° to 130°. There can be no doubt that the wide, open angle is the primitive or simian one; in this respect the Gibraltar

[1] *Man's Place in Nature, and other Essays*, p. 192.

[2] "Nuove Osservazione ed Induzioni sul Cranio Gibraltar," *Archiv. Anthropologia*, 1909, vol. xxxix. p. 5.

skull is very primitive. We can see, further, by a reference to figs. 79 and 80, that the wide, open angle is related to the downward flattening—to the degree of platycephalism —of the skull. A widely open pituitary angle, as in the Gibraltar skull, tends to pitch the face forwards, thus giving room for movements of the mandible. It has the same effect as a backward tilt of the head. The pre-pituitary part of the cranial base represents the axis of the maxillary part of the face as well as of the cranial

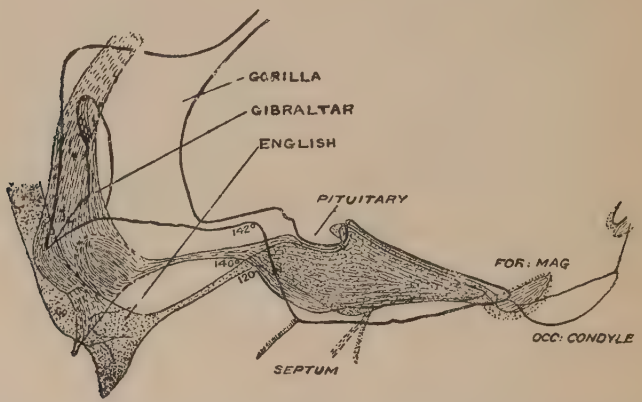

FIG. 80.—Superimposed tracings of the basi-cranial axis of the skull of a gorilla, of the Gibraltar skull, and of a modern English skull, to show the extent of the pituitary angle.

cavity. If this anterior part of the cranial base is bent downwards—towards the nose and mouth—as in skulls of the modern type, the facial parts are also necessarily bent downwards and backwards. The long base, the wide, open pituitary angle of the cranial axis, the long compressed form of the vault, the straight upper margin of the squama of the temporal bone, as seen on the side of the skull (see fig. 79), are all characters apparently correlated with a great maxillary development. They are also primitive or simian features. The essential difference between the Neanderthal and the modern types of skull is that the first, the Neanderthal, is an extended skull—the cranial base is opened out or extended at the pituitary

angle. In the second or modern type the skull is " flexed " —the bending of the cranial axis is increased.

I have dealt with the Neanderthal skull at some length. Every bone of the skeleton has its distinctive or specific characters. We have seen that Dr Henri Martin was able to identify an astragalus found at La Quina as that of a Neanderthal individual. It would be impossible to distinguish one modern race from another if we were to find merely an astragalus or ankle bone. The ribs, too, are peculiarly rounded. Professor Schwalbe [1] and Professor Klaatsch [2] published detailed analyses of the peculiar characters of the limb bones. At a later date, Professor Boule [3] restored a complete skeleton, and has attempted to give it a life-like pose. He represents Neanderthal man as a loose-limbed fellow with an easy, shuffling gait—knee and hip joints slightly bent. All the parts of his body are as perfectly adapted to the upright posture as are those of modern man. He was of low stature, varying from 5 feet 1 inch to 5 feet 5 inches. The height of La Chapelle man is estimated to have been 5 feet 1 inch (1555 mm.). I will content myself here by merely giving an outline drawing of the thigh bone of one of the Spy men—set between the thigh bone of a man of modern type and of a gorilla—as a sample to stand for the rest of the skeleton. It will be seen at a glance that the Neanderthal thigh bone does manifest in its general conformation a more simian character than the thigh bone of modern man. In the case of the tibia or leg bone, and particularly in the region of the ankle, anthropoid affinities are even more marked. On the other hand, as regards shortness of forearm and of lower leg, he was ultra-human. In anthropoid apes the forearm and lower leg, as compared with the upper arm

1 " Kritische Besprechung von Boule's Werk *L'homme fossile de la Chapelle-aux-Saints*," *Zeitschrift für Morph. und Anthrop.*, 1914, vol. xvi. p. 527.

2 *Praehistorische Zeitschrift*, 1910, vol. i. p. 272. *Ergebnisse der Anatomie*, 1907, vol. xvii. p. 431.

3 See reference, p. 174.

and thigh, are extremely long, and there are modern human races—particularly negro peoples—who show some approach to simian proportions. But in this, as in his teeth, Neanderthal man had departed farther from the simian standard than has modern man.

A survey of the characters of Neanderthal man—as

FIG. 81.—The Neanderthal (Spy) thigh bone contrasted with the corresponding bones of modern man and the gorilla.

manifested by his skeleton, brain cast, and teeth—has convinced anthropologists of two things: first, that we are dealing with a form of man totally different from any now living; and secondly, that the kind of difference far exceeds that which separates the most divergent of modern human races. If we were dealing with fossil animals which lie outside the pale of humanity we should probably give Neanderthal man, not only separate specific, but even a separate generic, rank, and distinguish varieties

or even species of Neanderthal men. Further, in most of the points in which the Neanderthal man departs from modern man he approaches the anthropoids. His peculiarities are pronouncedly simian. But not all of them; he has also his own peculiar adaptations and specialisations.

It is when we survey the great assemblage of his simian characters that we understand how he came at first to be regarded as our Pleistocene ancestor. Evolution was in the air—evolution from a simian ancestor. Here was a human form with simian characters swarming in the details of his structure. The belief in man's recent origin was also, in those early days, dominant. Neanderthal man presented himself to the pioneers of evolution as a later or Pleistocene stage in man's evolution. When, however, it was realised that men of the modern type, just as highly evolved in structure of bone and brain as men are now, must have been in existence when Neanderthal man was still living, it was apparent that if the Neanderthal type did at any stage become converted into a man of the modern type, that stage of evolution must have occurred before the Mousterian period, the one we are now dealing with.

Further, in size of brain Neanderthal man was not a low form. His skill as a flint-artisan shows that his abilities were not of a low order. He had fire at his command, he buried his dead, he had a distinctive and highly evolved form of culture—Neanderthal man was certainly not a dawn form of humanity. To find that form we must go to a period which lies far beyond the mid-Pleistocene age.

CHAPTER XI

MEN OF THE ACHEULEAN PERIOD

Our journey round Europe, described in the previous chapters, has led to the conclusion that it was inhabited, during the long Mousterian period, by a people altogether different from ourselves. When, therefore, we set out to seek for pre-Mousterian man, we are naturally on the tiptoe of expectation to see what kind of being we shall find. Was modern man evolved in some distant part of the world, reaching Europe for the first time in the Aurignacian period? Or was he the original inhabitant of Europe, being ousted during the time of the Mousterian culture by an intrusion or invasion of a foreign and strange species of man (*Homo neanderthalensis*)? It is clear that we must know the past history of the whole world before we can answer these questions with certainty. Meantime, we must rely on such facts as we now possess. We are feeling our way into a very distant period—one which lies forty thousand years or more behind the present.[1] Naturally, the farther back we go the greater

[1] The times assigned to the various cultural periods dealt with in previous chapters are as follows :—

Neolithic	2,000– 8,000 B.C.
Azilian	8,000–10,000 B.C.
Magdalenian . . .	10,000–13,000 B.C.
Solutrean	13,000–15,000 B.C.
Aurignacian . . .	15,000–20,000 B.C.
Mousterian . . .	20,000–40,000 B.C.

These estimates must be regarded as having a relative rather than an absolute value (see fig. 264).

become our difficulties and our doubts. Geological records, like historical documents, suffer by the lapse of time—they become mutilated, destroyed, or completely swept away. Seen in a distant perspective, a long period of time appears to us a short one.

The culture of the period we now enter—the Acheulean—is sparsely represented in the floor strata of caves and rock-shelters. At La Ferrassie, it will be remembered (fig. 62, p. 170), the stratum lying under the Mousterian contained objects of the older culture—the Acheulean. The chief records of this culture lie in deposits along the river valleys, in old stream-beds or in upland deposits laid down at various intervals during the Pleistocene epoch. The site which yields the classic implements of this culture (beautifully worked flint hand-axes) is situated at St Acheul, near Amiens, in the valley of the Somme. A replica of the terrace at St Acheul can be found in England, in that stretch of the Thames valley where we commenced to study the deposits and culture of the Mousterian period, and where I propose to take up the search for man of the older or Acheulean period. Fig. 82 shows the position of the various deposits—remnants of ancient beds of the Thames—to be investigated. The Mousterian culture was found in the 50-foot terrace—the low terrace of continental writers; it is the much older terrace—the 100-foot—which is to yield us traces of Acheulean man. At Swanscombe, situated on the south side of the valley, half-way between Dartford and Northfleet, the gravels and loams of the 100-foot terrace form an extensive deposit, in some places over 30 feet in thickness, resting on the chalk bluffs overlooking the river. To obtain the chalk for the production of cement, the overlying gravel deposits have to be cleared away. In the process of removal thousands of flint implements have been discovered at various levels in the gravel deposits. They exhibit a variety of styles in workmanship, many of them bearing evidence of great technical skill. In former days the implements were gathered by the workmen, and, from them, passed into the possession

of collectors. Swanscombe became renowned for its palæoliths.

In the corresponding deposits of the Somme valley, Professor Commont,[1] by a careful series of investigations extending over the opening decade of the present century, observed that the implements were always arranged in the same sequence or order when the deposits in which

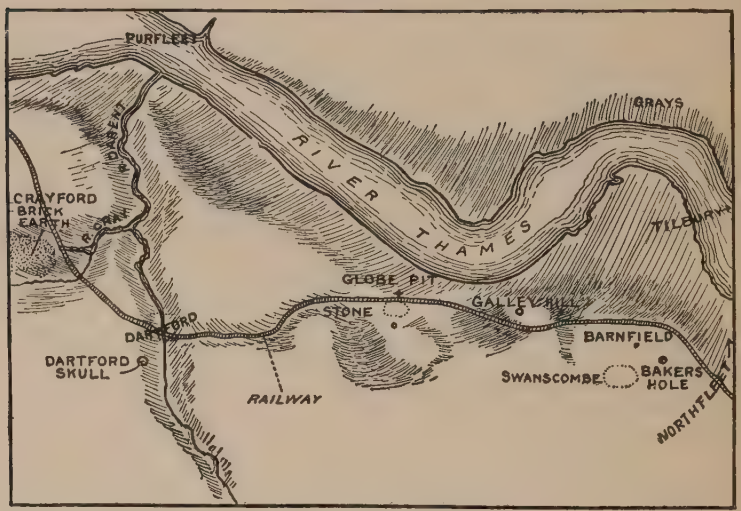

FIG. 82.—Swanscombe and neighbouring Palæolithic sites on the south side of the valley of the Thames, below London.

they occur are rightly dated. It was formerly believed that there was no cultural sequence of implements in the Thames deposits. Collectors believed that in the same stratum there may be found unabraded and unrolled implements of the most varied types of workmanship. To settle the question of sequence, a representative of the British Museum, Mr Reginald Smith, and one from H.M. Geological Survey, Mr Henry Dewey, were delegated, in the summer of 1912, to investigate the implements and deposits of the 100-foot terrace at

[1] See reference, p. 267.

Swanscombe.[1] The Associated Portland Cement Manufacturers, the owners of the chief pit at Swanscombe—at one time known as the Milton Street pit, but now as the Barnfield—gave them every facility and encouragement in their investigation. In fig. 83, I give, in a diagrammatic form, the chief results of their inquiry. They found that three series of deposits were represented in the 100-foot terrace—each series representing formations of a distinct period, each period marked by its own form of culture, a distinctive style of flint workmanship.

FIG. 83.—Diagram showing the various deposits of the 100-foot terrace of the Thames valley at Swanscombe, modified from Mr Dewey's sections.

The deepest and oldest of the three series of deposits is named "Strepyan" in fig. 83, because the implements found in it are of the type which M. Rutot discovered and named in the corresponding valley deposits of Belgium—especially at Strépy, a village to the west of Charleroi, lying within the watershed of the Meuse.[2] The Strepyan series of deposits consists of a deep bed of gravel (the "lower" gravel), made up of several layers; over the gravel a deposit of loam ("lower" loam) (see fig. 83). The gravel was laid down in the bed of the Thames when the river was flowing at a level of about

[1] See their report: "Stratification at Swanscombe," *Archæologia*, 1912, vol. lxiv. p. 177.

[2] Implements showing the Strepyan kind of workmanship are now assigned to a miscellaneous early group known as "Pre-Chellean."

100 feet above its present bed. The Strepyan series ends with a stratum of loam—a deposit formed in still water in times of flood. The second series of deposits, lying over the Strepyan, and therefore more recent, yielded, in its basal bed of gravel, the same kind of flint implement as occurs in the ancient deposits at Chelles, in the valley of the Marne, about eight miles to the east of Paris. At the time, then, when the second series of deposits in the 100-foot terrace began to be deposited, culture or civilisation of the natives of the Thames valley had entered the "Chellean" phase or stage. In the sands and loam, the later deposits of the second series, another culture appears—the older Acheulean, usually known as St Acheul I. The third and most recent series of the 100-foot terrace again commences with a stratum of gravel, in which implements of the later Acheulean type occur—St Acheul II. The stratum of gravel ("upper" gravel), marking the commencement of the third series, lies under the surface soil (fig. 83). The sands and brick earths which were probably present when the terrace was finished have been washed away long ago. To find the continuation of the third and last series of the 100-foot terrace, we must descend to the 50-foot terrace. This terrace has been already mentioned—at Crayford and at Baker's Hole (p. 158). Lying at the base of the brick earths, in which the culture of the Mousterian period is preserved, occur Palæolithic floors of the late Acheulean period. Acheulean man lived on the floor of the valley before the brick earths of the 50-foot terrace were deposited. In 1880, Mr F. C. J. Spurrell [1] found such a floor under the brick earths of the 50-foot terrace at Crayford. From the floor he gathered not only a finished implement, but also the chips which the workman had struck off in fashioning it, and part of the lower jaw of a rhinoceros—all of which he presented to the Natural History Museum at South Kensington. It is clear, then, the period we have now entered—the Acheulean—must be one of long duration. At its close the valley of the Thames

[1] *Quart. Journ. Geol. Soc.*, 1880, vol. xxxvi. p. 544.

was excavated almost to its present depth, for at such a level, buried beneath the deposits of the middle terrace, we find the work-floors of Acheulean man. It would have been more accurate to have written that the valley of the Thames was *re-excavated* in the Acheulean period for, as we shall see presently, unabraded Chellean implements are found in the gravels at the base of the 50-foot terrace.

The commencement of the Acheulean period is recorded, as we have just seen, in the upper series of the 100-foot terrace. It is plain, then, that the Thames carried out an enormous task during the Acheulean period. At the beginning of the period the floor of the Thames valley lay flush from side to side with the 100-foot terrace. A process of land submergence was then in operation, attended by a filling up of the valley, and by the formation of the upper series of Acheulean deposits on the 100-foot terrace. Afterwards an opposite movement set in, one of elevation of the land, leading to a re-excavation of the valley almost to its present depth. At Swanscombe the magnitude of such an operation is apparent, for the corresponding (100-foot) terrace on the opposite or north side of the valley lies eight to ten miles distant. The whole width of the valley was apparently cut down to an extent of 100 feet during the later part of the Acheulean period. It does not matter for our present argument whether the Thames cut her valley for the first time, or whether, as seems more probable, she only cleared out a former channel which had become silted up during a previous period of submergence. It is clear, when we consider the magnitude of the operations involved, that the Acheulean culture covers a long period of time, one more than equal to all the later Palæolithic periods put together—Mousterian, late Palæolithic, Neolithic, and Metal phases of human culture. If we pitch the commencement of the Mousterian period, as a provisional hypothesis, at a distance of forty thousand years, we must give forty thousand years more to reach the opening phases of the Acheulean period.

Considering the great duration of the Acheulean

period, and the abundant evidence of the activity and culture of the men of that time, it is surprising that so little has been discovered of the men themselves. In nearly every case where remains of man have been ascribed to the Acheulean period, the authenticity of the discovery has been questioned or denied. The very first instance I am to cite is one which is placed—and rightly placed so—to what the geologist calls a "suspense" account. These suspense cases often prove the most instructive. Such cases should not be allowed to pass into oblivion; the facts ought to be placed on record, to await the fate which will be assigned to them in the light of discoveries made at a future date. The suspense cases may prove false or prove true. They stimulate further research. The first discovery I am to mention brought to light the "Dartford" skull—supposed to be of Acheulean date. Dartford, as may be seen from fig. 82, lies some five miles to the west of Swanscombe, situated in the valley of the Darent where that stream breaks through the line of the 100-foot terrace and enters the marshy land on the south bank of the Thames. On the western side of the valley of the Darent, on the outskirts of the town of Dartford, a pit had been opened in a deposit of gravel, some 18 feet in depth. The stratified gravels, containing interpolated patches of loam, represent a deposit of the ancient Darent. The substratum of chalk on which the gravel rests is about 45 feet above the Ordnance datum line, and 30 feet above the Darent, which is about a third of a mile distant, to the east. In 1902, the pit, having proved unprofitable from a commercial point of view, was taken over by an ardent student of ancient man—Mr W. M. Newton, who then resided in Dartford. Between 1902 and 1908 "every bit of gravel excavated—some 5000 tons—passed under the deliberate scrutiny of my workman, and every evening his daily finds had my careful examination." [1] The majority of the implements discovered

[1] See Mr Newton's paper on "Palæolithic Figures of Flint," *Journ. British Archæolog. Assoc.*, March 1913, p. 3.

were of the later Acheulean type. They occurred especially plentifully near a black band in the gravel, which Mr Newton regarded as an indication of an old land surface. He also found numerous examples of "figure-stones"—curiously shaped natural flints, which, in some cases, had been deliberately chipped to give a semblance to the form of certain animals. Such figure-stones received the serious consideration of M. Boucher de Perthes (see p. 269).

The account of the discovery of a human skull, in the gravel of the Dartford pit, I shall give in Mr Newton's own words: [1]

> "I was, as you know, much interested in the gravel as producing implements and other curious forms of man-worked flints in the shape of animals and heads of animals. I was in the pit almost every morning and evening. Two men were working the face at the south end of the pit; two—Randall, Heron—the face at the north end. It was in the north face that the skull was found by the two men just named. They had broken into what is commonly termed a 'pot-hole,' into which it was impossible to see, as it lay 8 feet above the level of the floor of the pit, and about the same depth below the upper ground level. There was not the slightest appearance of any disturbance of the gravel such as might be produced by a deep grave above the pot-hole, and below the hole there were patches of sand, some loosely bedded large flints, and a black band that crops out at several points in the working.
>
> "On the morning of 26th May 1902, I entered the pit soon after 6 o'clock, when the skull was handed to me out of a heap of sand in which it had been preserved during the night. I had been in the pit the previous evening, after the men had left, and noticed that there had been a 'fall' of

[1] A letter to the Author, dated 27th February 1911.

gravel from the north face. The men informed me that with the fall the pot-hole disappeared and the skull was found in the débris. The men and I agreed at the time the skull must have come from the pot-hole.

"In the afternoon of the same day on which I obtained the skull, the north face of the pit was photographed for me by Mr E. H. Youens. Needless to say, I was impressed with the importance of the discovery. I offered rewards for the jaw, teeth, or any other bones; but, after much careful searching and sifting, no other human remains were found except the small pieces from the black deposit at a subsequent date. I did not publish an account of the finding of the skull, as I did not wish to draw attention to what I was doing with respect to the animal forms—figure-stones."

Before discussing the value of the Dartford skull [1] as an historical document, let us see what kind of man it represents—for there can be no doubt as to the sex, so strongly are the male characters developed. The skull, from which all the face is missing, is of unusual dimensions. The brain capacity is 1740 c.c.—fully 250 c.c. above the modern average. The great size of the brain need not make us sceptical of the antiquity of the skull. Even in the Neanderthal race, with all its ape-like characters, we have seen that some individuals, as at La Chapelle, went far beyond the modern average in mass of brain. Indeed, when we have become familiar with the implements of Acheulean man, we are prepared to find that the brain that conceived and executed such works of art must have been one of a high order.

The great dimensions of the Dartford skull are equally apparent when it is measured within the conventional frame (fig. 84). The maximum length is 207 mm.—17 mm. above the average for modern English skulls; the

[1] Mr Newton presented the skull to the museum of the Royal College of Surgeons in 1911, where it is now preserved. I am indebted to Mr A. S. Kennard for the first knowledge of Mr Newton's discovery.

width, 150 mm., is 10 mm. above the average. The width is almost 73 per cent. of the length: it is a dolichocephalic skull. The height of the vault is equally remarkable; it rises 129 mm. above the ear passages—13 mm. beyond the modern average. The supra-orbital ridges are prominent, but moulded as in modern man. The width of the forehead at the level of the supra-orbital ridges is remarkable—120 mm. The face must have been large and strongly developed. The forehead is wide, measuring 112 mm. between the temporal lines. The neck was thick, and the skull strongly implanted on

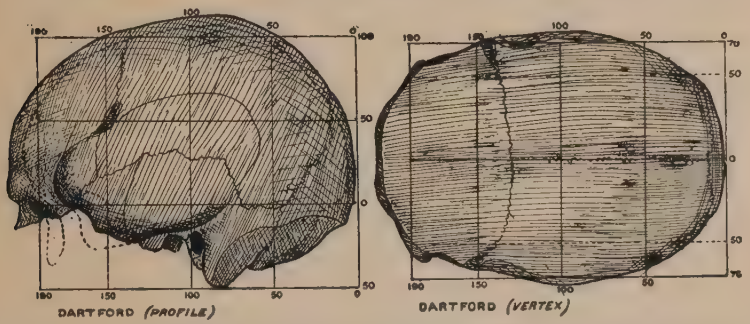

FIG. 84.—Profile drawing of the Dartford cranium and its outline from above, at right angles to the view given in profile.

it. The mastoid processes are massive, their apices reaching 35 mm. below the level of the upper border of the ear-holes. The width of the skull taken over the mastoid processes is 140 mm. The bones of the vault vary from 7 to 8 mm. in thickness.

If the question is put to a modern anthropologist: Does the Dartford skull show any feature which at once distinguishes it from skulls of the modern type? he must return the answer: No, not one! But it must also be remembered that the same may be said of every skull found in deposits which are later than the Mousterian period—the Combe Capelle, Cromagnon, Brünn, Grimaldi crania, not one of these shows any features which we are not familiar with in modern skulls. Indeed, in many of its characters the Dartford cranium agrees

with the Cromagnon type. In some minor characters it resembles the Piltdown skull. We thus obtain little or no aid from the skull itself in fixing its degree of antiquity. That must be determined on the evidence attending its discovery in the pit at Dartford.

We have to admit at once that the evidence of the Dartford skull being Acheulean in date is purely presumptive; the cranium was found apparently at a depth of 8 feet below the surface, in a gravel pit yielding abundance of Acheulean implements. It is believed to have been embedded at the level of the "black band," which may represent an old land surface. The pot-hole signifies a local subsidence of the gravel. To carry conviction, the cranium should have been seen and examined while still embedded in a stratum known to be Acheulean in date. We must also be certain that the stratum containing the skull, and all the more superficial strata, were intact and undisturbed. We have no guarantee of this kind in the case of the Dartford skull. In commercial ventures it is seldom that such a degree of verification is possible, and yet, if we insist rigidly on such conditions, we may reject the most valuable of documents and records. We should further expect that other bones besides those of man should occur at the same level, but at the Dartford pit no animal remains were observed. Further, we should expect the skull to show a high degree of mineralisation—or fossilisation—but the Dartford skull is not mineralised. Its surface is weathered, pitted, and of a light brown colour; when a fragment is broken, the freshly fractured surface is grey and chalky. The condition does not suggest, but it does not exclude, a high antiquity. There is one remarkable feature to be seen on the inner surface of the cranium. The skull apparently lay, while embedded in the gravel, with its right side down and its left up. There was a perforation on the upper or left side, at which a drip of water must have entered, and then have passed round the inner aspect of the vault, making its exit at a small hole on the right or deep side of the skull. The drip has worn a groove or channel in

the bone, about 10 mm. wide and 3 mm deep. The ear-holes contained a brown, sandy loam similar to that found in the pit. Further, the skull shows no signs of battering or erosion; it could not have rolled far in the moving gravel in the bed of a stream. As a document, then, the Dartford skull is inconclusive. We cannot cite it as evidence that men of the modern type lived in England during the Acheulean period; yet we cannot reject it, for it may be authentic.

In our search for Englishmen of the Acheulean period, we may, on leaving Dartford and the Thames valley, turn our steps in several directions. His workmanship [1] has been found in the terraced deposits of the river valleys of the Portsmouth district and of Hampshire—both in the lower (15-foot) terrace and also in the upper (100-feet) terrace, but of the man himself, not a single bone has been seen. It is worth our pains, however, to turn to the valley of the Lea, were it only to become acquainted with the remarkable discoveries of the late Mr Worthington G. Smith.[2]

The Lea rises in the uplands of South Bedfordshire, some thirty-five miles to the north-west of London; the lower reach of its valley, as it embouches on that of the Thames, separates the northern from the eastern suburbs of London. It was at Stoke Newington and Highbury, northern suburbs, that Mr Worthington Smith discovered the land surface on which Acheulean man had lived and worked. He commenced his search in 1878, being then a man of forty-five, and by 1883 had traced, by following the trail of implements, the land trod by Acheulean man. This ancient land surface, he found, had extended over miles of a country now covered by streets, houses, and cemeteries. He was able to prove that the strata which carried the old "work-floors" had, at one time, stretched right across the valley of the Lea from Stoke Newington

[1] L. S. Palmer and J. H. Cooke, "Pleistocene Deposits of the Portsmouth District," *Proc. Geol. Assoc.*, 1923, vol. xxxiv. p. 253.

[2] Mr Worthington G. Smith, born 1835, died 1917, aged eighty-two. Author of an excellent book, *Man, the Primeval Savage*, London, 1894.

on the west to Leyton on the east—a distance of a mile and a half. Since the time in which Acheulean man lived in these parts, the Lea has deepened its wide valley by 20 feet at least, carrying away the old land surface,

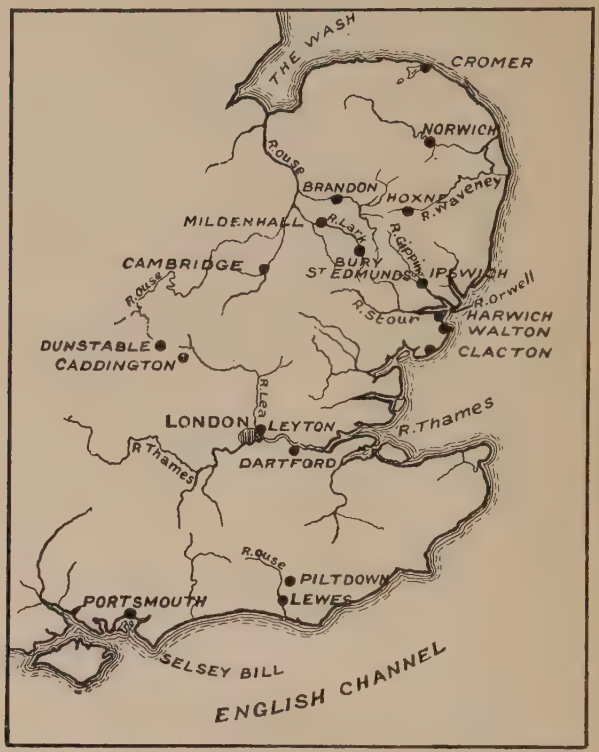

Fig. 85.—A sketch map of the south-eastern parts of England, showing the position of certain sites mentioned in the text.

and the strata of brick earth which had formed over and buried the Acheulean work-floors. It is important to note that the upper layers of the brick earth always show a disturbance; they have been twisted and contorted under the influence of ice action.

In 1884 Worthington Smith visited the uplands at the source of the Lea, and was surprised to find amongst the material which had been used to mend a road at

Dunstable Acheulean implements of the Stoke Newington type. Determined to trace these to their source, he soon afterwards made his home in Dunstable and succeeded in the object he had in view. His search led him to the brick-makers' pits on Caddington Hill, midway between Dunstable and Luton (fig. 85), where the land rises 560 to 595 feet above sea-level. A section of the deposits in one of the Caddington

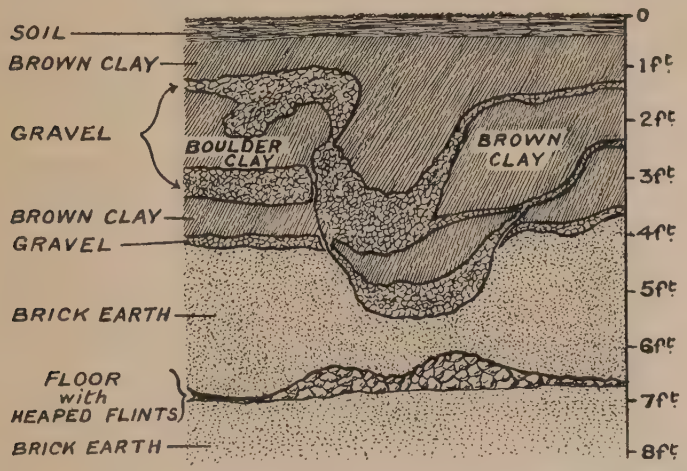

FIG. 86.—A section of the deposits in one of the Caddington Hill pits, showing the Acheulean work-floor discovered by Mr Worthington Smith. (After Worthington Smith.)

pits is shown in fig. 86; it reveals a work-floor on which the Acheulean flint-knappers shaped their tools. On the floor are to be seen rough flints gathered into heaps; between the heaps lay numerous chips and flakes; also imperfect implements which had broken in the knappers' hands or been discarded in a partially worked state. The discoverer, by patiently assembling scattered flakes, was able, in several instances, to reconstruct the original rough block of flint, all save the empty core. When plaster of Paris was poured into the empty central space it took on the shape of a perfect Acheulean hand-chopper.

Although Worthington Smith did not succeed in finding any fragment of the skeleton of Acheulean man, yet his discovery of a work-floor in the brick earths of Caddington Hill gives us a glimpse of the kind of life led by men in this upland corner of England at a very remote period. The flint workings seem more extensive than the needs of a local family or even a local tribe would demand; we seem here to have struck a factory for the manufacture and export of Acheulean implements. However this may be, there can be no doubt, as Worthington Smith proved, that the work-floor was situated on the bottom of a wide dip or hollow, which was surrounded by higher ground. As may be seen from fig. 86, strata of brick earth—in some places 30 feet in depth—lie under the work-floor, representing loams and sands which had been washed into the hollow by winter rains and summer showers before the flint-knappers chose the site as a working place. Later, after the flint heaps were abandoned—for what reason we cannot now tell—brick earth continued to accumulate, burying the work-floor (fig. 86). Thereafter the weather conditions seem to have changed markedly; alternate layers of gravel and of clay were washed from the surrounding land surfaces into the hollow, filling it up and burying the older brick earths. In these gravel-beds were found abraded and rolled flint implements of that great period which preceded the Acheulean—the Chellean. Swollen rushing rivulets had deposited here gatherings from the ancient land-surface on which Chellean man had lived. Then, as may be seen in fig. 86, these upper strata of gravels and clays had subsequently been broken and contorted by the pressure and movement of ice. In all upland places which yield Acheulean implements the conditions are just those which Worthington Smith met with on Caddington Hill. The implements are found in deposits of brick earth; these have accumulated in ancient hollows, lake bottoms, or river beds; the upper strata, if they have not been washed away, are broken and twisted by glacial conditions. A glacial period set in

long after the milder period of Acheulean man had come to an end.

We must say good-bye to Caddington Hill, on the southern border of Bedfordshire, and take a journey of some sixty miles eastwards to examine an upland deposit of brick earth in which a fragment of a human skull was found—a fragment assignable to the Acheulean period. Our quest takes us to the ancient town of Bury St Edmunds in West Suffolk, situated on the Lark, a tributary of the Ouse (fig. 85). From the deposits in the valley of the Lark, a few miles below—to the north of—Bury St Edmunds, the late Dr Allen Sturge gathered a collection of implements which represent man's handiwork during all the periods of Palæolithic culture. About two miles to the west of Bury St Edmunds lies the rural parish of Westley, where the land rises about 100 feet above the level of the Lark. On the highest ground, in this area, numerous depressions or pockets in the chalk occur, some 10 to 14 feet in depth, filled with deposits of brick earth. In 1882, Mr Henry Prigg,[1] a well-known archæologist, lived in the neighbourhood, and kept a close watch on such pits as were worked for brick earth, because they were known to yield implements of that type which are now recognised as characteristic of the Acheulean culture. Remains of the mammoth also occurred; it was reported that a human skeleton had been found at a considerable depth in one of them. Late in the autumn of 1882 a workman found part of the vault of a human skull at a depth of 7½ feet (2·27 m.) in the brick earth. Mr Prigg verified the find, and published an account of the fragment and of the palæoliths found in neighbouring pits at about the same horizon as the skull. Mr Reginald Smith assures me that these palæoliths are of the type usually assigned to a late phase of the Acheulean period.

In order to throw a clearer light on the age and nature of the brick earths in which the Bury St Edmunds find was made, it is advisable, before describing the kind

[1] He afterwards changed his name to Trigg.

of man indicated by the fragment, to extend our journey twenty miles to the eastward, to Hoxne (fig. 85), where implements of the Acheulean type were first discovered. It is a cross-country journey, which takes us into the shallow valley of the Waveney, a stream flowing eastwards on the confines of Suffolk and Norfolk. As long ago as 1797, John Frere collected flint "spear heads" by the score from the brick earths of Hoxne, described them,[1] and recognised both their antiquity and their human origin. John Frere's discovery was forgotten until the year 1859, when Boucher de Perthes, after a struggle of twenty-five years, convinced the world in general and the leading English geologists in particular, that the curiously shaped flints in the terraces of the Somme—particularly those at St Acheul—were of human workmanship and fashioned when species of animals now extinct were alive. It was then that the importance of Frere's investigations at Hoxne was realised. Sir John Evans and Sir Joseph Prestwich visited Hoxne, and found the brick earths and Frere's implements. In 1895–96, nearly a century after Frere's discovery, the British Association sent a Committee—its most active member being Mr Clement Reid—to investigate the relationship of the deposit of brick earth to that of the chalky boulder clay which was then believed to mark the most severe of all the glacial episodes of the Pleistocene age. The annexed diagram (fig. 88) is compiled from the records of the Committee.[2] The Committee found that the Hoxne brick earths, about 7 feet in thickness, represented the topmost of a series of deposits filling an ancient valley which had been about 50 feet in depth. The valley had been cut by a stream in the chalky boulder clay and the mid-glacial sands; it was clear the Hoxne valley had been formed and filled after the deposition of the chalky boulder clay and the close of the major glaciation. The bottom of this ancient valley is rather below the present level of the valley of the Waveney. The

[1] *Archæologia*, 1800, vol. xiii. p. 206.

[2] See *Report of British Association for* 1896 (Liverpool), Section C, p. 1.

lower 20 feet of the deposits filling the valley is composed of clay laid down in still, fresh water. Then follows a deposit containing remains of plants which prefer a temperate climate. Then another deposit, about 20 feet in depth, of black loam with remains of Arctic plants. Finally, a layer of gravel on which rest the brick earths, containing Acheulean flints.

An inspection of the strata at Hoxne convinces us that the Acheulean period occurred long after the time of the

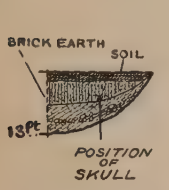

FIG. 87.—Section of the pit in which the Bury St Edmunds fragment was found.

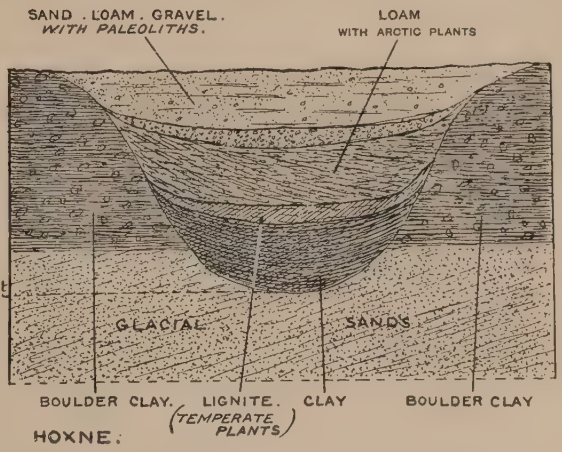

FIG. 88.—Section of the deposits at Hoxne.

major glaciation; a valley had been cut to a depth of at least 50 feet and filled up again. In the interval between the formation of the boulder clay and the brick earth the climate has changed at least twice. We have seen, from the formation of the 100-foot terrace, that the Acheulean period is very remote from our day; at Hoxne we see that the major glaciation was equally distant from the Acheulean period.[1]

[1] Mr A. S. Kennard, whose opinion regarding the age of Pleistocene deposits deservedly carries great weight, believes an error has been made in assigning the Acheulean flints to the brick earth above the Arctic bed (*Proc. Prehist. Soc. East Anglia*, 1916, vol. ii. p. 261). He believes they came really from below the Arctic bed and that this bed is of the same date

Returning now to the pit at Bury St Edmunds, we cannot have any doubt that the brick earth, in which the fragment of skull was found, is of the same age and formed in the same way as the brick earth at Hoxne (figs. 87, 88). They are dated by the later type of Acheulean implements. The fragment itself, which is preserved in the Moyses Hall Museum at Bury St Edmunds, still shows, in its interstices, particles of red brick earth. It is stained a light reddish-brown. When struck, it has the resonance of porcelain. The freshly fractured surface has the colour of chalk, except that the spaces in the bone are tinged with the brick earth. It is evident, from the brown, weathered, rounded edges of the specimen, that only a fragment had been present in the pit; the workmen had not detached it from a complete skull. It may have been the stray part of a skull, lying on the surface of the land in Acheulean times, and washed, with other surface deposits, into the pit. At the present time the Lark is 100 feet below the level of the pits.

Unfortunately, the fragment is not sufficient to permit one to reconstruct the original skull with any degree of certainty. Some time ago [1] an opportunity was given me of making a minute examination of this fragment of a human skull. From the appended illustrations the extent of the fragment will be seen. The upper two-thirds of the frontal bone, and about the anterior third of the right and left parietal bones are preserved. In attempting to reconstruct the original, I first searched for an English skull showing, in the fronto-parietal region, the same form and proportion of parts, the same kind of

as the Arctic bed at Ponder's End in the Lea valley, which is post-Mousterian in age. The writer has again read over Mr Clement Reid's report and cannot see how an error of level could have been made. He therefore concludes that the brick earths at Hoxne, lying above the Arctic bed, did contain Acheulean implements and that the brick earths at Hoxne are of the same age and origin as those at Caddington Hill. As will be mentioned later (see p. 301 of this edition), the boulder clay shown in fig. 88 is the deeper and older stratum corresponding in age to the Cromer Till.

[1] See *Journ. Anat. and Physiol.*, 1913, vol. xlvi. p. 73.

sutural lines between the bones. Its prototype I found in a skull obtained from a gravel deposit in the east end of London—of uncertain antiquity. I next tried to find a counterpart for it amongst all known examples of Neanderthal skulls. The male crania, such as the Neanderthal calvaria itself, the specimens from Spy or from sites in France, were altogether different. The only crania, presumably Neanderthal in nature, which at all resembled the Bury St Edmunds specimen, were those fragmentary skulls of women and children found at Krapina. In none of those, however, was the sharp, frontal bend present which is to be seen in the upper region of the forehead of the Bury St Edmunds fragment. The frontal bone, at this bend, is remarkably thin—only 3·6 mm.; I cannot believe that on such a forehead great simian eyebrow ridges were implanted. In the upper part of the frontal bone, and in the parietals, the bones thicken to the moderate dimensions of 6 to 8 mm. The characters, so far as we have examined them, clearly indicate a person with a head of the modern type. Mr Prigg formed the opinion that it was part of a woman's skull, and with that conclusion I agree. Further, from the fact that the sutures between the separate bones are closed on the inner aspect and open on the outer, the woman may be regarded as over forty years of age.

The next point I tried to determine was: How much of the frontal bone is missing? In an average English skull the length of the frontal bone, measured from the bregma (see fig. 184, p. 530) to the nasion (at the root of the nose), reaches to about 130 mm. The actual amount present in the Bury St Edmunds fragment is 89 mm. I have presumed that about 35 mm. are missing from the lower part. If such an amount is restored, the forehead assumes a natural proportion. It is not likely that I have underestimated the amount missing, for, in the lower part of the frontal bone (see fig. 89), there is present an extension of the frontal air sinus. It is unusual in skulls of the modern type to find the air

sinuses ascending more than 30 mm. above the nasion. In Neanderthal skulls the frontal air sinuses have a less

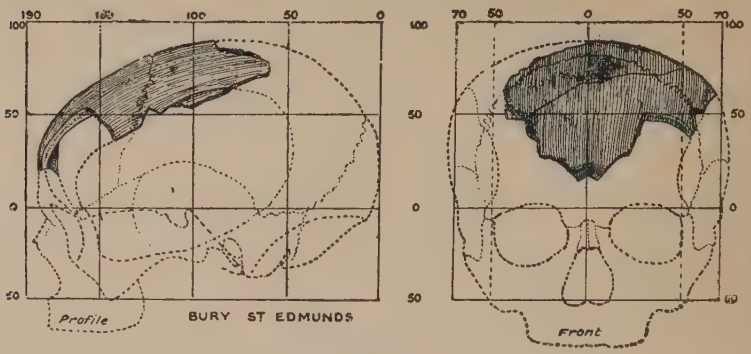

FIG. 89.—Bury St Edmunds cranial fragment viewed from the side and from the front.

extensive development than in skulls of the modern type. From the drawings which are given in figs. 89 and 90

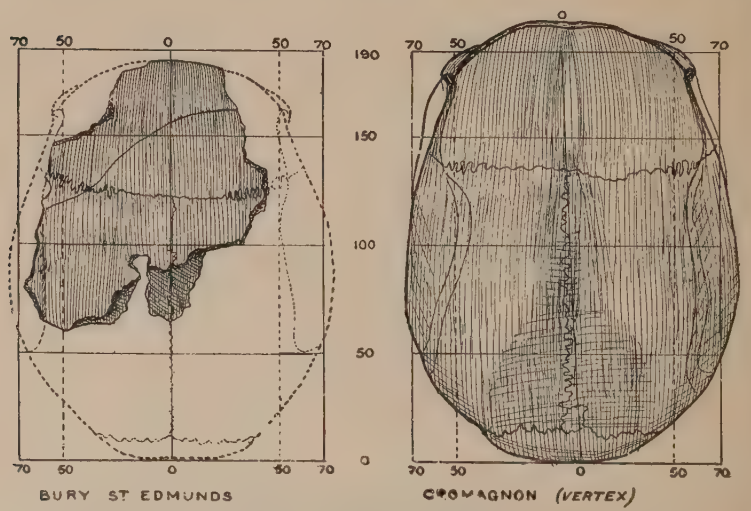

FIG. 90.—The Bury St Edmunds fragment viewed from above. The upper aspect of a Cromagnon skull is placed beside it for comparison.

it will be seen that the Bury St Edmunds fragment can be conveniently oriented within the outline of a modern

skull. The original skull was certainly, as regards length, below the modern average, even for women. I have allowed 125 mm. for the length of the parietal bones measured along the vault of the skull—a very ample allowance. The lambda, at the hinder end of the sagittal suture between the parietal bones (see fig. 89), has been placed 10 mm. in front of the occipital projection or pole of the skull. The length of the skull is thus represented as 183 mm.; it could be made shorter, not longer. The vault is remarkably flat on the top—a character in which the Bury St Edmunds fragment resembles Neanderthal skulls. It may be suspected that the pressure of the earth, in which the fragment lay, has produced a post-humous flattening, but such an explanation is improbable when the symmetrical character of the coronal suture, between the frontal bone and the parietals, is observed. From the width and flattening of the vault, one infers that the original transverse diameter of the skull could not have been less than 148 mm., the width being thus 80 per cent. or 81 per cent. of the length. Such a skull would be classed as brachycephalic, but it is of a totally different type from modern brachycephalic skulls, the vault is so low. At the utmost, on the allowances given for the frontal and parietal bones, the height of the vault above the ear-holes could not be more than 105 mm.[1] The brain capacity of such a skull, using the Lee-Pearson formula, $183 \times 148 \times 105 \times 0{\cdot}4 \times 206 = 1340$ c.c.—a brain capacity about equal to that of the modern Englishwoman.[2]

Thus of all the people who lived in England during the long Acheulean period, fashioning the multitude of implements which mark the deposits of their time—many of them implements which show high skill and artistic tastes—only two documents remain to tell us what kind of men and women they were. One of these documents,

[1] In my paper in the *Journ. of Anat.* the illustrations show the correct height, 105 mm., but an error is made in the text. The height is given as 115 mm. instead of 105 mm.

[2] For further details of this formula, see p. 596.

the Dartford skull, is of very doubtful authenticity; the other, the Bury St Edmunds skull, is such a fragmentary document that one may well hesitate in forming any certain conclusion as to the type of person it represents. We know only their flint implements. Such habitations or shelters as they may have built, such implements as they fashioned in less durable material than stone, have been destroyed by the lapse of time.[1] We have seen that valleys, which had been filled up, were again excavated during the Acheulean period, except in such cases as at Hoxne, where the river system had been changed. The filled-up valley at Hoxne, with brick earths on the top, containing the implements discovered by Frere, remains now as at the close of the Acheulean period. In the Thames valley the Acheulean deposits have apparently been swept away, all except a fringe or terrace here and there.

Before leaving East Anglia, mention must be made of recent excavations which throw further light on Acheulean times. The town of Ipswich, to which we shall return in a future chapter, looks to the south and west, being built on the northern side of the Gipping valley. It rises up the terraced incline until it reaches the brow of the plateau which stretches away to the north and to the east, covered by a great sheet of chalky boulder clay. To the east of the town, and situated on this plateau at a height of 120 feet above sea-level, is a disused brick-yard —known as the Derby Road Brick-yard. The brick earths of this yard have a depth of over 28 feet, and in them thirteen separate layers may be distinguished. They had accumulated here, as at Hoxne and Caddington Hill, in an ancient valley or lake. For many years they have been known to yield flint implements, representing several types. In 1922, Professor P. G. H. Boswell and Mr Reid Moir, in order to settle the exact derivation of those implements, determined to explore, in the most

[1] This is not strictly true; Mr Worthington Smith and Mr Hazzeldine Warren found pieces of cut and pointed wooden stakes in deposits of Acheulean date.

scientific manner possible, a virgin part of this deposit.[1] Beneath the sandy surface soil (2 feet 7 inches in depth) they came on two layers (4 feet 3 inches in thickness) which yielded implements of the Mousterian type. Then followed four strata of brick earths, over 9 feet in thickness, which carried implements of the later Acheulean type; then, deeper still, a stratum, nearly 2 feet in depth, which yielded Acheulean implements of the older or earlier type. Then followed various layers, over 12 feet in thickness, which were sterile so far as worked flints were concerned. Lastly came the chalky boulder clay on which these brick earths rested. The implements found in the various strata were unabraded; they lay at or near the spot where they had been dropped. As at Hoxne, so here, we find a stratum of boulder clay under the brick earths of the Acheulean period; there was, therefore, a glacial episode before the appearance of Acheulean man in these parts. But in the deeper brick earths of the Derby Road yard there was no Arctic bed as at Hoxne and no upper contorted drift as at Caddington. We have to take all three deposits into account in formulating a true rendering of that chapter of Pleistocene history we are now seeking to decipher. Professor Boswell and Mr Reid Moir drew the just conclusion that there are two strata of chalky boulder clay—an upper and more recent and a deeper and older, the stratum under the brick earths of the Derby Road pit being the deeper and older sheet which long preceded the appearance of Acheulean man. We shall see that Mr Reid Moir regards the upper and more recent sheet of chalky boulder clay as of Mousterian age.

As already mentioned, we shall have occasion to return to Ipswich and to the Gipping valley, but before returning to the valley of the Thames to take up our search for the men of the Chellean period—the long period which went before the age of the Acheulean culture—there are two neighbouring sites which we should visit now because

[1] P. G. Boswell and J. Reid Moir, *Journ. Roy. Anthrop. Instit.*, 1923, vol. liii. p. 229.

they throw some light on the conditions of life during the distant period with which we have been dealing. One lies on the south side of the Gipping valley, almost opposite to Ipswich. Here, at a height of 70 feet above the level of the river, is a deposit of brick earths which have yielded the fossil remains of animals of the later part of the Acheulean period and the early Mousterian. The deposits in which these fossil remains are found have been studied by Miss Nina Layard ; [1] she found there the remains of the great extinct ox (*Bos primigenius*), of the red deer (*Cervus elaphus*), and of the horse, which tell us of green pasture lands and remove the impression likely to be engendered by our ever-recurring mention of brick earths, for such suggest that the land surface on which men of the Acheulean and Mousterian cultures lived was bleak and strewn with earth and mud. The wolf was there, so were the cave-lion and the cave-bear. The cold-loving mammoth was represented by numerous teeth.

Leaving the neighbourhood of Ipswich and following the coast of Essex, we pass Harwich, Walton-on-Naze where the skeleton of a Neolithic woman was found (see p. 47), and reach, a few miles beyond, Clacton-on-Sea (fig. 85).

Here there is a remarkable series of Pleistocene deposits which have been described lately by Mr Hazzeldine Warren.[2] In this district there are remains of the 100-foot terrace of the Thames valley, containing implements of the Chellean type. At Clacton this ancient terrace has been cut across by a river or stream which has now vanished. At an early part of the Acheulean period its valley became silted up and in the brick earths thus deposited occur certain peculiar flint implements and animal remains which have a direct interest for us now. The implements are of an early Acheulean type, such as were found by M. Rutot in Belgian deposits and named by

[1] Miss Nina Layard, "The Stoke Bone-Bed," *Proc. Prehist. Soc. East Anglia*, 1920, vol. iii. p. 210.

[2] *Proc. Prehist. Soc. East Anglia*, 1922, vol. iii. p. 597.

him Mesvinian. We seem to have here evidence of an intruding culture which never made headway in Acheulean England; there are even grounds for supposing that England may have been thus early the subject of invasions. It is also noteworthy that the elephant which appears in these early Acheulean deposits at Clacton is not the mammoth—but the older and warmth-loving type—*Elephas antiquus*. It was in these same Clacton deposits that Mr Hazzeldine Warren found the pointed end of a wooden spear. The more we get to know of Acheulean deposits in England, with their evidences of mighty alterations in level of sea and land, of great changes in climate and in fauna, the more convinced we become that the period we have been dealing with was one which covered an enormous span of years.

In the next chapter but one, a search will be made on the Continent for remains of Acheulean man. The Continent, it will be seen, repeats the story of England—such remains as have been found of the Acheuleans are, with the possible exception of the find at Ehringsdorf, not of the Neanderthal but of the modern type. All the same, we must recognise that at this period the ancestors of both types must have been already in existence in some part or other of our world.

CHAPTER XII

GALLEY HILL MAN

In this chapter we again return to the valley of the Thames to take up the story of early man in England. The period we are now to enter—the Chellean—is of even greater duration than the Acheulean, to which we have assigned a length of forty thousand years. In seeking to estimate the duration of these remote periods in terms of years, we certainly lay ourselves open to a charge of foolhardiness, but it is a form of daring which is justified by the present state of our knowledge. One cannot review the facts and events which geologists and archæologists have gleaned from these remote periods of human culture without forming a mental estimate of the time which is needed for their execution or evolution. Our estimate may prove to be over the mark or under it; we shall soon discover on which side we err if we have in our minds a definite term of years to serve as a working hypothesis. When we consider the extent of the geological changes which occurred during the time Europeans shaped their stone implements in the Chellean style, we see that the period must have been one of long duration. For, in the earlier phases, the bed of the Thames was flush with the 100-foot terrace—in the later phases the river had worn, perhaps re-worn, its valley to the level of the lowest gravel beds of the 50-foot terrace. We are justified, I think, in assigning a term of fifty thousand years to cover the period with which we are now dealing. Our estimate thus places the beginning of the full Chellean period in Western Europe at so remote a date as one

hundred and thirty thousand years ago ; its end we place at about eighty thousand years before the Christian era (see fig. 264).

At this point the reader may put the question : Why should the periods of Palæolithic culture become longer and longer in their duration as we pass backwards in our scale of time ? To later Palæolithic periods we assign a duration of four thousand and five thousand years ; to these more remote periods forty thousand and fifty thousand years. All evidence goes to prove that human culture follows the rule which holds for sums of money placed out at compound interest ; as time goes on the rate of increase becomes ever faster. We have to remember, too, that in these remote periods Europe was sparsely populated and that its few inhabitants had to struggle hard to merely hold their own.

Having thus indicated how remote from us is the period with which we are now dealing, we take up our search for Chellean man. The site of our first inquiry is at Galley Hill, a few hundred yards more to the west, and rather nearer the river, than the Barnfield pit at Swanscombe (fig. 82, p. 226). The school and school-house at Galley Hill stand on the brow of the 100-foot terrace, overlooking the river. The London road passes behind the school as it threads its way eastwards, along the brink of the 100-foot level. In 1888, cement workers had quarried into the chalk bluffs both to the north and to the west of the school, until they had almost reached the London road. Workmen were then—in 1888—busy removing the gravel of the 100-foot terrace in order to expose the underlying chalk. The stratum of gravel—as they approached the road—was between 10 and 11 feet in thickness. It was while this area was being worked near the London road, a little to the west of the school, that the skeleton of the Galley Hill man came to light —the only representative so far discovered of the generations who lived during the period of Chellean culture. Our conception of the antiquity of man, especially of man of the modern type—for undoubtedly

the Galley Hill man is formed in the same mould as we are—turns on the authenticity of this discovery. It is therefore of the greatest importance to examine with care every fact relating to the find at Galley Hill.

The discovery was made late in September 1888. The first evidence I am to cite is a letter from Mr Robert Elliott [1]—a printer by trade, but an enthusiastic collector of everything relating to prehistoric times—to Mr E. T. Newton, the letter being written when Mr Newton was preparing for publication a descriptive account [2] of the Galley Hill man in 1894—six years after the actual discovery :

> " According to my promise, I write to let you know the particulars of my find of human remains in undisturbed gravel, capping the chalk, at the top of Galley Hill, in Kent, at the end of September 1888.
>
> " It was my custom to visit the pits at Milton Street, Swanscombe, Galley Hill, and neighbouring excavations every fortnight regularly (in search of flint implements) for more than two years before the discovery of the human remains—so that I was well acquainted with the fact beforehand.
>
> " It was on one of my fortnightly visits that I was informed by a man, named Jack Allsop (who had for a long time looked out and saved for me any implements or stones of similar shape, obtained while screening the ballast), that he had found a skull under the gravel. This I could hardly credit at first ; but on my asking him to show it to me, he produced it in several pieces from the base of a pillar of laminated clay and sand, where he had hidden it. I asked where the rest of the bones were. He pointed to the section opposite this pillar, and a few

[1] Mr Elliott died, at the age of seventy, in 1909. He was a Scot—one of the " black " Elliotts from the Border country. In his old age he fell into financial straits, and had not Mr Frank Corner, M.R.C.S.(Eng.), at great personal sacrifice, rescued the Galley Hill and other specimens, they would have passed into a continental museum.

[2] See *Quart. Journ. Geol. Soc.*, 1895, vol. li. p. 505.

feet from it, and told that he had left the other bones undisturbed for me to see; and there, sure enough, about 2 feet above the top of the chalk and 8 feet from the top of the gravel, portions of bone were projecting from a matrix of clayey loam and sand. He also told me that several of the men employed at the works, the master of the neighbouring school, and others had seen the skull.

"The section of gravel was 10 or 11 feet thick, and extended for a considerable distance along the south and east end of the pit; several pot-holes or pipes running from it, deep into the chalk. I carefully examined the section on either side of the remains, for some distance, drawing the attention of my son, Richard, who was with me, and of Jack Allsop to it. It presented an unbroken face of gravel, stratified horizontally in bands of sand, small shingle, gravel, and, lower down, beds of clay and clayey loam, with occasional stones in it—and it was in and below this that the remains were found. We carefully looked for any signs of the section being disturbed, but failed: the stratification being unbroken, and much the same as the section in the angle of the pit remaining to this day; but it was then clear and not covered by rubbish, as it now is in places, all the 'callow' loam at the top being at that time removed to allow of the gravel being got at.

"I went on my knees, and with the point of my geological hammer and a knife tried to work round each piece of bone; but soon gave up the attempt, as the bones were so friable and fragile that many went to pieces as soon as touched, so that I decided to work about a foot each way from the bones. Jack Allsop and I went to work, and we were fortunate enough to obtain the fragments which are now in your keeping [Mr Newton's]. So friable were they that we had to place them on soft, newly screened sand to harden in the atmosphere, where I allowed them to remain between four and five hours, by

which time they became a little hardened, and I carefully wrapped them in soft paper and brought them home. These bones had been left *in situ* by Jack Allsop, because of their being too soft for him to get out, and also in order that I should see them exactly as he found them. Within a few days of my obtaining them, you will, I think, remember that I brought the skull to you in pieces, and you kindly offered to piece the remains together for me; but I preferred taking them away, as I then intended to work the subject up and describe and publish my find. This I have been unable to do, not having the necessary leisure from business, and I regret not having placed them in your hands before. The remains have been in my museum ever since, and no one has interfered with them, except myself and a few friends in my presence. So you have them exactly as they were found, except that I have dipped them in a solution to preserve them. In May last, my friend, Mr Frank Corner of Poplar, saw these remains and urged me to place them in someone's hands, so that a description of them might be published."

It will be observed from Mr Elliott's letter that the master in the school, which overlooks the site of discovery, also saw the remains when they were still embedded in the gravel bank. By good fortune, the schoolmaster, Mr Matthew H. Heys, was also interested in prehistoric research, and was, as the following letter shows, alive to the importance of the find made by the workmen. In the summer of 1910, when Mr Frank Corner, into whose possession the Galley Hill remains had passed, gave me an opportunity of verifying Mr Newton's description of the skull and skeleton, I obtained the following letter from Mr Heys :—

"Some time ago, in 1888, my attention was called to some bones found in the gravel in close proximity to the Galley Hill School, where I was then the head

teacher. As soon as the intimation of this find was received, I visited the gravel pit, and there saw a few bones and about a third part of a skull (part of the top and side) just exposed by a workman excavating the gravel. To all appearances these bones were human. These were so intensely interesting to me, as I found almost daily Palæolithic implements in this gravel, and here might be the remains of a man belonging to the clan or tribe who had made these very implements. No doubt could possibly arise to the observation of an ordinary intelligent person of their deposition contemporaneously with that of the gravel, for there was a bed of loam, in the base of which these human relics were embedded. The underneath part of the skull, as far as I could see, was resting on a sandy gravel. The stratum of loam was undisturbed. This undisturbed state of the stratum was so palpable to the workman that he said, 'The man or animal was not buried by anybody.' The gravel underneath the skull, of which I took particular notice, was stratified and undisturbed.

"My next step was to induce the workman to desist from exposing these relics further until a photograph of them *in situ* had been taken; and meanwhile he was to cover them carefully with gravel. To my utter astonishment and indignation, a day or two after, and before I could get a photographer, I found they had been removed by Mr R. Elliott, then a stranger to me, and without their having been photographed. My anticipated possession of them was thus thwarted. I soon learned there was a working arrangement between Mr Elliott and the workman whereby the latter was subsidised to find fossils, implements, etc., for the former.

"For a long time I took but little interest in the discovery, and this may account for my meagre description given to Mr E. T. Newton at the time

when he read a paper before the Geological Society, of their Galley Hill skeleton. However, since then, I have been reconciled to the loss, for they fell into better hands than mine in many respects.

"I cannot give details of the loamy stratum which formed the matrix for these osseous remains, nor exact measurements of the position of the ancient relics. The gravel bed was about 10 feet thick, resting directly upon the chalk and the loamy stratum, about 2 feet 6 inches from the bottom.

"MATTHEW H. HEYS.

"*12th July* 1910."

There can be no doubt that in September 1888 the Galley Hill skeleton was found at a depth of about 8 feet in the 100-foot terrace, resting in a stratum of loam. The workman, Jack Allsop, Mr Elliott, and Mr Heys were all qualified to form an opinion as to whether or not the terrace over the skeleton was intact. In their opinion it was. That was also the opinion which Mr Newton formed in 1894—on an examination of all the evidence then available. Mr Newton's verdict must carry weight with all geologists, for he has spent a lifetime in laying, soundly and solidly, a foundation for our knowledge of the animals which lived during recent geological periods. His eminence as a geologist, and especially his caution as a thinker, are the best guarantees we could have that these human remains belong to a man who lived while the 100-foot terrace was still in process of formation. For my part, when I commenced a systematic examination of these remains in 1910 my attitude towards them was one of scepticism. The discovery of a man—differing only in details from men now living in England—in so ancient a formation seemed at variance with a belief in the orderly succession of evolutionary stages in man's early history. It was only when I saw that there was no possibility of denying the authenticity of the discovery without doing an injury to truth, that it became apparent to me, as it had done to

many other inquirers,[1] that the find at Galley Hill had to be accepted as a fact, and that our beliefs regarding man's antiquity must be modified accordingly.

The gravel terrace in which the Galley Hill skeleton was found represents a direct extension of the deposits at Swanscombe. As was mentioned in a former chapter, Mr Reginald Smith and Mr Dewey found that the gravels in the Barnfield pit at Swanscombe represented at least three series of deposits of three different ages. In which of these three series of deposits were the human remains embedded at Galley Hill? In the Barnfield pit (see fig. 83) there are two strata of loam—an upper, containing implements of the Acheulean period; a lower, resting on the deepest or basal layer of gravel, and lying under a bed of gravel containing implements of the Chellean age. In the gravels at Galley Hill the same types of implements were found as at the Barnfield pit. There can be little doubt that the skeleton lay in the lower bed of loam—the one under the Chellean gravel. The stratum belongs to the oldest or basal series of deposits of the 100-foot terrace. In the basal gravel occur the Strepyan or pre-Chellean form of Palæolithic implements.

M. Rutot, who has done so much to systematise and date the deposits found in river valleys, not only recognised that the Galley Hill man lay in a deposit of Strepyan age, but regarded him as a representative of that time. It is in the deposits of the same period, as M. Rutot was the first to demonstrate, that the early Europeans really applied themselves to stonecraft in earnest—shaping in a rough and crude manner the kind of implements which foreshadow the magnificent tools of the Chellean age. That the pioneers of the great periods of stone culture—the inventors of the palæolith—should be highly evolved men with big brains did not surprise

[1] M. A. Rutot, "L'âge probable du squelette de Galley Hill," *Bull. Soc. Belge de Géol.*, 1909, vol. xxiii. p. 239. Professor V. Guiffrida-Ruggeri, *Archiv. per l'Antropol.*, 1910, vol. xl. p. 3. Professor H. Klaatsch, *Zeitschrift für Ethnologie*, 1909, vol. xli. p. 537; *Praehist. Zeitschrift*, 1910, vol. i. p. 296.

M. Rutot. When, however, we look more closely at the facts revealed at the time of the discovery there is good reason for assigning the Galley Hill man to the subsequent or Chellean period. When, as at Galley Hill and at Halling, representations of a complete skeleton are found, with all the parts in close proximity, it is almost certain that the remains have not been entombed by Nature, but by the hand of man. When Mr Newton read his paper before the Geological Society, Sir John Evans, who took part in the discussion which followed, said that "the occurrence of a nearly perfect skeleton was suggestive of an interment," and "ventured to maintain an attitude of doubt regarding the antiquity of the remains." At that time, twenty-nine years ago, the custom of burial was supposed to have been introduced at a comparatively late stage of human evolution. Since then, the discoveries in France have revealed deliberate burials as long ago as the Mousterian period. If we accept the discovery at Galley Hill as authentic, we must also accept the great antiquity of the human custom of burying the dead. We hardly do justice to the men who shaped the Chellean weapons if we hold them incapable of showing respect for their dead. Certain it is that the remains found at Galley Hill are not those of a low type of man. In size, and in the richness of its convolutions, the brain of the Galley Hill man does not fall short of the average man of to-day.

We must admit, then, that a burial had been made at Galley Hill—but when? It was before the Thames had laid down the final series of deposits in the 100-foot terrace. Mr Elliott, Mr Heys, and Jack Allsop saw that the overlying, stratified deposits were unbroken. They showed no trace of having been broken by a burial made from the present land surface. As at Halling, we must search for an old land surface, such as may be represented in the Barnfield pit by the stratum of gravel, containing implements of the Chellean type, and lying over the lower stratum of loam—the one in which the human remains were apparently embedded. Weighing

all the evidence, we are forced to the conclusion that the Galley Hill skeleton represents a man of the Chellean period, buried when the lower gravel formed a land surface. The land surface of Chellean times became submerged by the later or Acheulean deposits of the terrace.

Having thus brought forward the evidence relating to the high antiquity of the human remains found at Galley Hill, we proceed to ascertain what kind of individual they represent. As to the sex there can be no doubt—the bones of the skull and limbs show all the characters which mark the male. Nor can there be much doubt as to his age. The sutures between the bones on the vault of the skull are almost closed—represented only by traces; he was past middle age, probably about fifty. His thigh bones, both of which were found, measure 422 mm., indicating a stature of 1600 mm. (5 feet 3 inches)—a short man. Unfortunately, neither of the leg bones—tibiæ—is complete, but by comparing the fragments with complete specimens of both Neanderthal and modern types of tibia, an approximate estimate may be made of their original length—between 320–325 mm. The leg was thus about 77 per cent. of the length of the thigh—the usual proportion for modern man. The relatively long leg of negroid, Aurignacian, and of some Neolithic races, was not a character of the Galley Hill race. As to the relative proportions of the upper limb, little can be said, for the bones of the forearm were not found. The lower end of the right humerus has been broken away. The original length of this bone was probably between 305 and 315 mm.—a dimension to be expected in a modern man of 5 feet 3 inches. One peculiar feature of his organisation is worth noting here. The great pectoral muscle, which rises from the inner third of the collar bone or clavicle, and from the front of the thorax, and which passes in front of the arm-pit to act on the upper end of the humerus, was particularly well developed. The impressions for this muscle on the collar bone and humerus

are extensive and pronounced. The bones are those of a well-made man of medium strength. The skeleton does not show a single feature which can be called Neanderthaloid, nor any simian feature which is not also to be seen in the skeletons of men of the modern type. The Galley Hill man represents no strange species of mankind; he belongs to the same type as modern man.

Such are the general features of the Galley Hill man. For students of human races the form of head and face has a special significance. In this part of our inquiry a special difficulty confronts us. We have seen that the bones when first exposed were quite soft; the skull warped as it dried. To anthropologists who refuse to recognise any but perfect specimens, the Galley Hill skull will probably be regarded as an unreliable document. Were we to wait for the discovery of perfect prehistoric crania, the early story of man might never be written. We have to make the best of what is found, and, in the case of the Galley Hill skull, it is not difficult to make a due allowance for defects which arise from warping or earth-pressure. The skull, in all its characters, is of the type familiar to students of the human body—it is an extremely long, narrow skull, with a low vault. When viewed in profile and placed within the conventional frame (fig. 91), it is seen to exceed the average modern English skull by 14 mm.—fully half an inch—its maximum length being 204 mm. From the front the skull appears to be flattened from side to side (fig. 91), the width having been originally just under 140 mm. The man was pronouncedly long-headed, the width being approximately 69 per cent. of the length. We have already seen that most of the Palæolithic Europeans, especially of the Aurignacian period, had exceptionally long heads. In any large modern population on the western side of Europe, individuals with heads of a very similar size and shape could still be found. The height of the vault above the ear-holes in this ancient skull is 120 mm.—a low amount when compared with the length, and yet in

absolute amount above the modern average. In size of brain the Galley Hill man is not unlike the modern average man, but an exact estimate is not possible. From direct measurement it was found that the brain mass measured between 1350–1400 c.c., but when we employ the indirect method and calculate the capacity from the diameters of the skull—using the Lee-Pearson formula—a capacity of 1500 c.c. is obtained. In actual size of brain, the Galley Hill man did not differ materially from

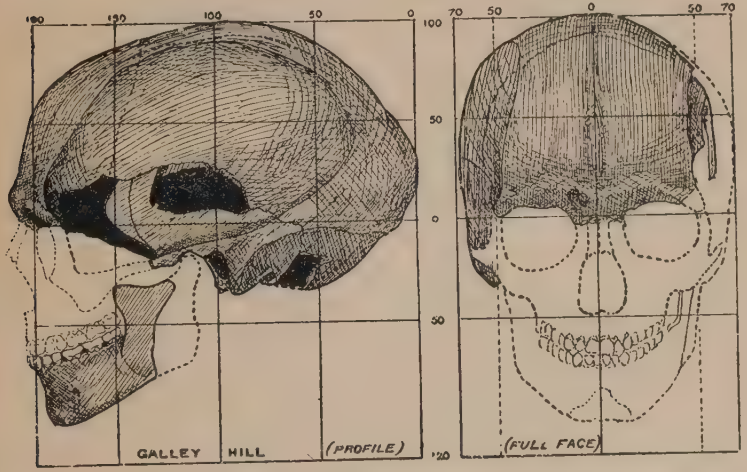

FIG. 91.—The Galley Hill skull viewed from the side and from the front, the face being restored.

modern man. The cast of the brain, which Mr F. O. Barlow made from the skull, shows that, so far as concerns the convolutionary pattern, the Galley Hill man was not inferior to the average modern European. The areas or lobes which are specially associated with the senses of sight, hearing, and touch, were all there; so, too, were the convolutions which are concerned in speech and in movements of the limbs and body.

The question of speech naturally leads our inquiry to the lower jaw—particularly to the region of the chin. Fortunately, the greater part of the left half of the lower jaw, and the whole of the region of the chin, were

recovered. There are no Neanderthal marks at the symphysis of the jaw: the markings which indicate the origin of the chief muscles of the tongue are shaped and placed as in modern man. From the conformation of the brain and of the chin—being exactly as in modern man—we draw the conclusion that the faculty of speech was fully evolved. It is difficult to suppose that the race which invented and mastered the high art shown by

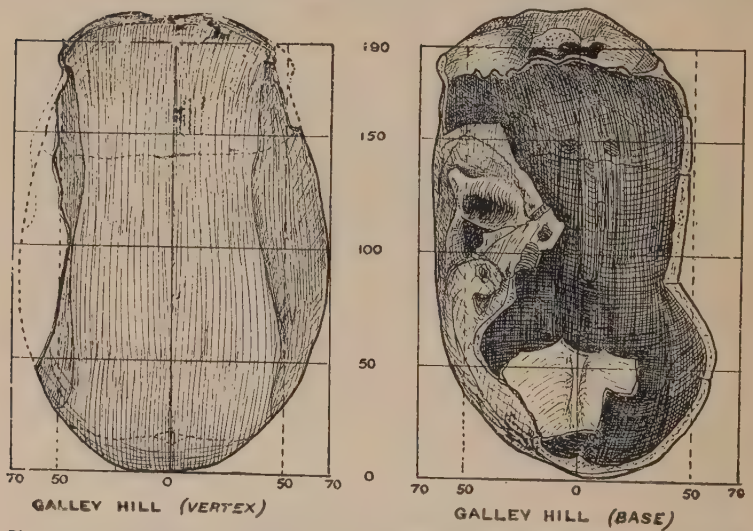

FIG. 92.—Drawings of the Galley Hill skull from above and from below. The latter shows the degree of twisting or torsion.

Chellean implements had not, long before, attained the gift of speech. When it is remembered we are dealing with a period—the Chellean—which, so it is estimated from the physical changes that have occurred since, lies at least one hundred thousand years beyond our time, it will be seen that a great claim is made, not only for the antiquity of man, but for the antiquity of human culture.

The reader will have a difficulty in believing that human remains, to which so great an antiquity is assigned, do not show in their structure, as well as in their degree of fossilisation, some evidence of their ancient origin.

They do. In the first place, the condition of preservation is peculiar—quite unlike any bones of Neolithic or of Palæolithic date I have ever seen. Mr E. T. Newton is perfectly familiar with the degree of fossilisation seen in bones from the 100-foot terrace. He and other authorities regard their condition as evidence of their high antiquity. Besides, there are in the Galley Hill skeleton some minor structural parts which indicate a primitive form of man. The skull is thick, the vault varying from 10 to 12 mm.—altogether an exceptional measurement. The eyebrow ridges, although of the modern, bipartite form, are yet exceptionally pronounced. The middle or supraciliary parts are continuous with the lateral or malar parts, as in the most uncivilised of modern races. In the lower jaw itself, some primitive features are present.

Drawings of the mandible from the side are given in figs. 91 and 95. The ascending branch or ramus, which articulates with the base of the cranium, by means of the articular condyle, does not show the sigmoid notch or bay usually seen on its upper border. This notch is situated in front of the articular condyle, and behind the coronoid process to which the chief muscles of mastication are attached. In all modern races, in most of the late Palæolithic, and in all Neolithic races, the sigmoid notch is deep. In the Galley Hill ascending ramus a notch is almost absent. Its absence is a primitive feature. The joint on the base of the skull for the condyle of the jaw shows, in its shape and size, the characters seen on the skulls of primitive races of the modern type. The ear-hole is remarkably large; the mastoid process behind it, on the other hand, is small. The area for the temporal muscle, the chief muscle of mastication on the side of the skull, is abnormally extensive, indicating large muscles of mastication.

Five teeth remained implanted in the mandible—the two premolars and three molars of the left side. The other lower teeth—incisors and canine—had dropped from their sockets after death. The crowns of the molar

teeth are worn—not deeply—in the manner seen in the dentitions of races living on a crude, vegetarian diet. The teeth themselves are not large, the total length of the crowns of the three molar teeth being 34·5 mm. The last molar is slightly longer than the second. The width of the molars—the diameter between the cheek and tongue margins—is less than the length. All of those features are such as we expect in an individual of a very primitive type : a combination of such characters would

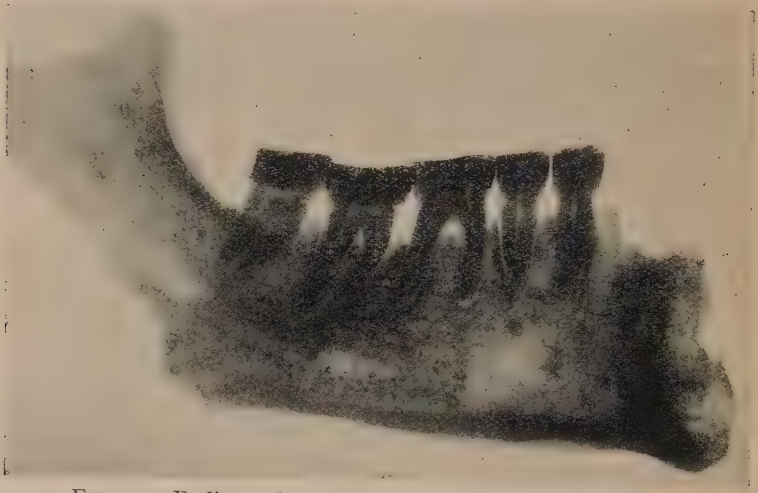

FIG. 93.—Radiograph of the Galley Hill mandible and teeth.

be very difficult to find in any European of modern or of Neolithic date.

When the Galley Hill jaw and teeth are examined by X-rays, we see that there is no trace of the peculiar specialisation—the enlargement of the pulp cavity—taurodontism—which characterises, in a greater or lesser degree, the teeth of Neanderthal man (see p. 210). In fig. 93 is reproduced an X-ray photograph of the teeth and mandible. The teeth show primitive characters ; in all their parts they are of an older and a more simian type than the molars of Neanderthal man.[1] The

[1] For an account of the Galley Hill teeth, see reference, p. 252 (Newton), p. 211 (Keith).

pulp cavities, in place of being large, as in adult apes with worn teeth, are particularly small. The smallness of the cavity is due to the fact that it is being rapidly filled up by the formation of secondary dentine—Nature's way of protecting the sensitive pulp from being exposed, as the crown is worn by chewing. In shape of root, as well as in size and relative proportion of crown, Galley Hill teeth show a primitive human type. We need not, then, reject the Galley Hill remains on account of the modernity of their structure and characters; they do show some primitive marks such as might be expected in an ancient form of European.

Mention has been made of the large muscles of mastication. The facial parts of the skull are gone, and we cannot measure the size of the palate directly. But we can estimate its size by an indirect method. More than half of the lower jaw is present; the size of the arcade, formed by the lower teeth, is known. From the lower set we can calculate the form and size of the upper set. In this way we reach the conclusion that the area of the palate (see p. 102) was between 29 and 30 cm.^{2}—its length being 53 mm., its width, 66 or 67 mm. These dimensions are not exceptional; on many modern skulls, especially of primitive races, palates of equal or even greater dimensions are to be found.

Why is it, then, that anatomists and geologists have been so reluctant to acknowledge the antiquity of the Galley Hill remains? The anatomist turns away from this discovery because it reveals no new type of man, overlooking the much greater revelation—the high antiquity of the modern type of man, the extraordinary and unexpected conservancy of the type. The geologist regards the remains with suspicion for two reasons—first, he has grown up with a belief in the recent origin, not only of modern civilisation, but of modern man himself. He expects a real anatomical change to mark the passage of a long period of time. Further, at a much later date than the formation of the 100-foot terrace, a very primitive type of man survived in Europe—such a

type as answers exactly to the evolutionist's expectation of a human ancestral form. The discovery of human remains of the Neanderthal type confirmed geologists in their opinion that Pleistocene man must be of a more primitive—at least of a different—type from modern man. Hence the rejection of all remains—such as those found at Galley Hill—which do not conform to this standard.

Nor must we shut our eyes to the difficulties we have to face if we accept Galley Hill man as an authentic representative of Chellean man—man of one hundred thousand years ago. We have, if we accept his authenticity, to believe that the Western European type has come down through this long period of time—involving the reproduction of some four thousand generations—and yet has undergone but minor changes in structure. Either this has been so, or the geological record at Galley Hill is at fault. Modern authorities, almost without exception, when faced with this alternative, reject the geological record, preferring to believe in the rapid mutability of the human body and the recent evolution of modern man. Time will tell which is in the right; in the meantime we have to accept facts as we find them.

CHAPTER XIII

PRE-MOUSTERIAN MAN IN FRANCE AND ITALY

A JOURNEY of a little over one hundred miles from Galley Hill lands the traveller at the town of Abbeville, situated on the estuary of the Somme in the north-east of France. On the higher grounds of the northern suburbs of Abbeville, we find an exact counterpart of the terrace we have left at Galley Hill. Thanks to the pioneer labours of the late M. Commont,[1] Professor at l'École Normale of Amiens, a city on the Somme fully twenty miles above Abbeville, not only the exact structure of the 100-foot or 30-metre terrace—also named the middle terrace—is known, but also the sequence of flint implements contained in the various strata of this terrace. Indeed, it was M. Commont's discoveries in the terrace of the valley of the Somme which led to the inquiries at Swanscombe by Mr Reginald Smith and Mr Dewey. These gentlemen found in the 100-foot terrace of the Thames valley, as we have just seen, the same triple series of deposits, and the same cultures as M. Commont had previously discovered in the 30-metre terrace at Abbeville and at Amiens. Even in the most ancient Palæolithic times, intercommunication between France and England must have been sufficiently advanced to allow a free interchange of culture. In fig. 94 is given M. Commont's section of the 100-foot terrace at

[1] *Les gisements paléolithiques d'Abbeville* (Lille, 1910). See also *L'Anthropologie*, 1908, vol. xix. p. 527; *ibid.*, 1911, vol. xxii. p. 575. *Compt. Rend.*, 1911, vol. cliii. p. 1256. Professor Victor Commont died in 1918. He was born in 1866.

Abbeville, as shown in the Carpentier gravel pit. The lowest series of deposits, resting on the chalk, is made up of a gravel, a greenish clay, and a chalky loam or marl. The worked flints found in this series belong to an older culture than the Chellean—they are pre-Chellean. The second series of deposits is represented by a gravel and an overlying bed of light-coloured sands yielding flints of the Chellean period. The third series of deposits begins with a seam of flints, or gravel, containing implements

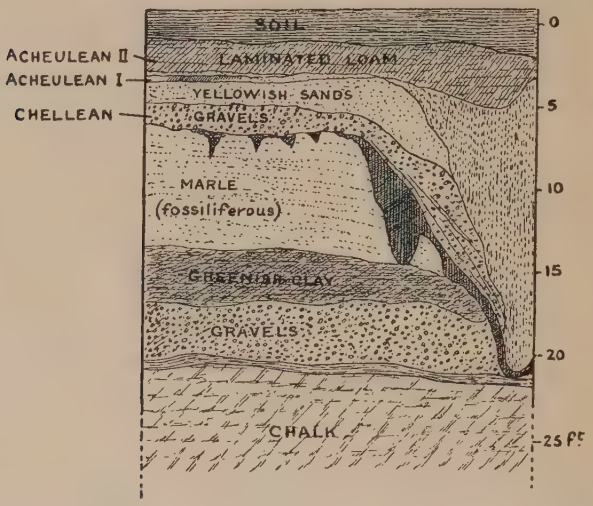

FIG. 94.—Section of the 30-metre terrace at Abbeville (V. Commont).

of the first Acheulean [1] culture; in the overlying bed of red, sandy, laminated loam—"limon fendille"—occur the later Acheulean implements of the type found in the brick earths at Bury St Edmunds. Often in the deeper layers of the last-mentioned stratum occur black bands of manganese. At the Carpentier pit, as at the Barnfield, the series of deposits ends with the late Acheulean culture; but in other sites in the same terrace, and particularly in the lower or 50-foot terrace, deposits of a later date occur, containing implements of the Mousterian, Aurignacian, and other late Palæolithic cultures. Our visit to Abbe-

[1] St Acheul is near Amiens.

ville assures us that in the river valleys of the adjoining parts of France and England occur the same sequence of terraces, deposits, and cultures.

The investigations of M. Commont belong to the commencement of the twentieth century. Seventy years before his time even more remarkable discoveries were made at Abbeville. In 1825, M. Boucher de Perthes, then a man of forty-one, was placed in charge of the customs of the town. In the years following the date of his appointment, cave exploration was attracting the attention of antiquaries. It was in 1833 that Schmerling published the results of his investigations at Engis. No one had ever looked, or even thought of looking, in the gravel deposits of valley terraces for human implements until Boucher de Perthes took up his abode in the Somme valley. The terraces were known to contain the remains of extinct animals, and their formation was supposed to predate man's appearance. About the year 1832 this antiquarian exciseman first noticed very curiously shaped stones in the gravel pits. These stones, we now know, represented human implements of the Acheulean type. We are not surprised that he recognised in those stones the work of man's hand and of man's brain, but we have a difficulty in understanding why those to whom he showed them did not agree with him. Even in 1847, when he had published the first part of his great work, *Antiquités Celtiques et Antédiluviennes*, he had not gained a single convert. Indeed, his discovery was regarded in the light of a joke. In 1858 the public attitude towards Boucher de Perthes' work began to change, and in that change Dr Hugh Falconer, whom we have come across before as explorer of the Brixham cave, gave a helping hand. He had in his younger days made known the extinct animals found in the Siwalik formations in India, and in 1858 was searching the caves on the shores and islands of the Mediterranean for fossil animals. On his way to the caves he had the good fortune to call at Abbeville and to meet Boucher de Perthes. He realised at once that this local antiquarian,

in charge of the customs-house at Abbeville, had made a great discovery—one which revealed an ancient and unsuspected chapter of human history. Falconer was one of a remarkable group of British scientists, embracing Sir Charles Lyell, George Busk, who brought the Gibraltar skull to England, Joseph Prestwich, a wine merchant and geologist, John Evans, a paper manufacturer and antiquarian, and John Lubbock, banker, naturalist, and anthropologist. Falconer prevailed on his friends to visit Abbeville. The result was that this brilliant school of geologists became convinced that Boucher de Perthes' interpretation was right—that the implements were of human workmanship and that man had lived when the 100-foot terrace was being formed.

In 1863 another famous find by Boucher de Perthes brought the English geologists back to Abbeville. The discovery was made in the Moulin Quignon pit in the 100-foot terrace at Abbeville, a few hundred yards to the east of the Carpentier pit (fig. 94), so thoroughly investigated by Commont.

The Moulin Quignon pit, like others along the valley of the Somme, had yielded a rich harvest of Palæolithic implements—including Acheulean and Chellean types—to Boucher de Perthes, but not a trace of the man who fashioned them, although liberal rewards were held out to the workmen in the pits. On 23rd March 1863, the long-expected discovery was made; on that day Boucher de Perthes removed with his own hand a human jaw from the lower gravels of the Moulin Quignon pit. The mandible lay [1] in a well-known, particularly black stratum of sand and gravel which contained many flints of the Acheulean type—"coup-de-poing," or "hand-axes," as they were then called. The black stratum was 5 m. (16½ feet) below the surface of the pit, almost on the chalk. The section of the Carpentier pit (fig. 94) shows how the upper or third series of deposits may dip down almost to the chalk, as they evidently did at Moulin

[1] For a full account of the discovery of, and conference on, the Moulin Quignon jaw, see *Nat. Hist. Rev.*, 1863, vol. iii. p. 423.

Quignon. The news of this discovery brought the English group of geologists hot-foot to Abbeville. It was the first discovery of "river-drift"—terrace-gravel man. At first the visitors were impressed favourably. Then it was found that some of the implements in Boucher de Perthes' collection were forgeries, foisted on him by the workmen. The Englishmen returned home in doubt, bringing with them the jaw, and also an isolated human tooth found in the same stratum. Falconer and Busk took the jaw to the museum of the Royal College of Surgeons, and cut it across to see the state of fossilisation. They also made a section of the isolated tooth. The cut surface of the tooth and of the jaw appeared surprisingly well preserved and fresh; they were really shocked to find it contained as much as 8 per cent. animal matter. This was the circumstance which turned their suspicion into a serious doubt, although on the shelves of the museum in which they had met there was a series of specimens, prepared by John Hunter in 1792, to show that the bones of Pleistocene animals may contain as much as 30 per cent. of animal matter. Gimbernat had even made a jelly from the bones of the mammoth. Then a curious thing happened. In May of the same year, 1863, the English geologists went to Paris to meet in solemn conclave their confrères of France and pass sentence on the jaw. The conference broke up leaving the French section convinced that the Moulin Quignon jaw was an authentic document, and the English that it was a forgery. French anthropologists continued to believe in the authenticity of the jaw until between 1880 and 1890, when they ceased to include it in the list of discoveries of ancient man. At the present time opinion is almost unanimous in regarding the Moulin Quignon jaw as a worthless relic. We see that its relegation to oblivion begins when the belief became fixed that Neanderthal man represented a Pleistocene phase in the evolution of modern races. That opinion, we have seen, is no longer tenable.

Was Boucher de Perthes tricked? Let us look at the

specimen, or rather at an exact cast of the specimen, for it is on that I have had to base my examination. The mandible was originally covered by the black specks of the stratum in which it lay. Mr Busk found he could brush these specks off; that does not invalidate its authenticity. The shape of the mandible is remarkable. In fig. 95, I reproduce the appearance of the jaw as seen from the side, in true profile. Beside the Moulin Quignon specimen, I have placed a similar outline of

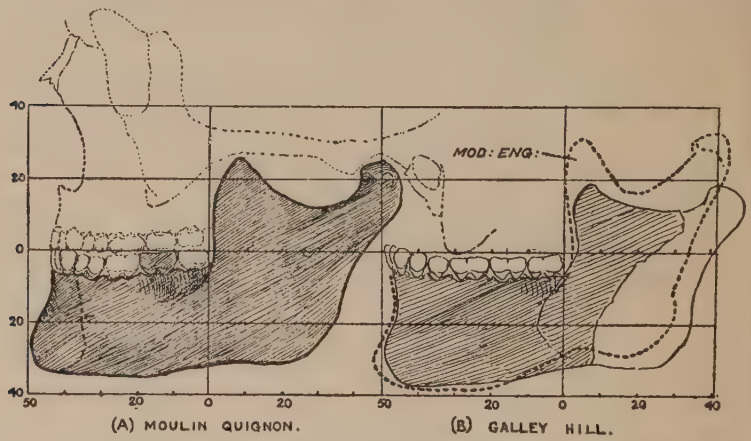

FIG. 95.—(A) A profile drawing of the Moulin Quignon mandible. (B) A profile drawing of the Galley Hill mandible. On the latter a stippled outline of a modern English mandible is superimposed.

the mandible of the Galley Hill man. It is then seen that the ascending branch of the Moulin Quignon jaw, bearing the articular condyle and coronoid process, is altogether of remarkable width—50 mm. at its widest part and 35 mm. at its narrowest. The body of the jaw is not deep as measured from its upper or tooth-bearing border to its lower. Indeed, it is shallow, but its thickness, measured from the inner to the outer surface in the region of the molar teeth, is of more than average amount. In the region of the chin and symphysis, all the markings and features found in the chin region of modern man are present. When a comparison is made with the Galley Hill mandible (fig. 95), the Moulin Quignon specimen is,

on the whole, the less primitive. Its ascending branch is the wider, but the Galley Hill ramus shows the more shallow, and therefore more primitive, notch between the condylar and coronoid processes.

Another specimen which attracted the attention of Huxley, Busk, and Falconer in 1863, but which disappeared soon after, has a very remarkable resemblance to the Moulin Quignon mandible (fig. 96). This specimen is known as the Foxhall mandible because it was found in a sand-pit situated on the Suffolk plateau in

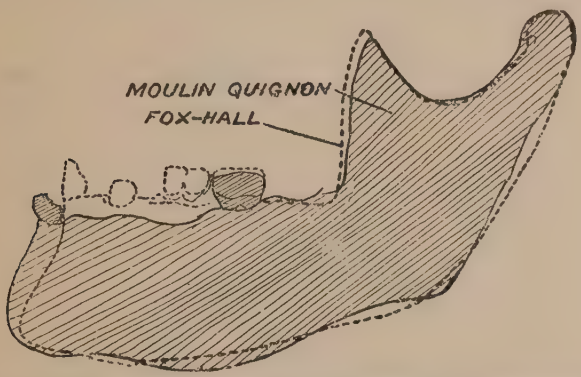

FIG. 96.—Stippled outline of the Foxhall mandible superimposed on a drawing of the Moulin Quignon specimen.

the parish of Foxhall, four miles to the east of Ipswich. Mr Reid Moir [1] has reinvestigated the deposits in the Foxhall pit, particularly the coprolite stratum from which, it is believed, the jaw was derived, and has also sought to trace the jaw itself. Although in this he has not been successful, there can be no doubt that it showed all the features we associate with the modern European type, including a well-developed chin. A drawing of this mandible, given by Dr Robert H. Collyer,[2] leaves no doubt as to its character. In fig. 96, the outline of the Foxhall mandible is superimposed on that of the Moulin

1 *Proc. Prehist. Soc. East Anglia*, 1921, vol. iii. p. 389.

2 "The Fossil Human Jaw from Suffolk," Robert H. Collyer, M.D., *Anthrop. Rev.*, 1867, vol. v. p. 221.

Quignon specimen and it will be seen that in size and in shape they are almost identical.[1] Difficult as it may be to believe in the authenticity of Boucher de Perthes' find, it is more difficult still to accept the Foxhall jaw as a true fossil, for, as we shall see later (p. 307), this East Anglian specimen comes from a much older geological horizon than the French counterpart found in the neighbourhood of Abbeville.

In the figure, 97, I contrast the Abbeville jaw with that

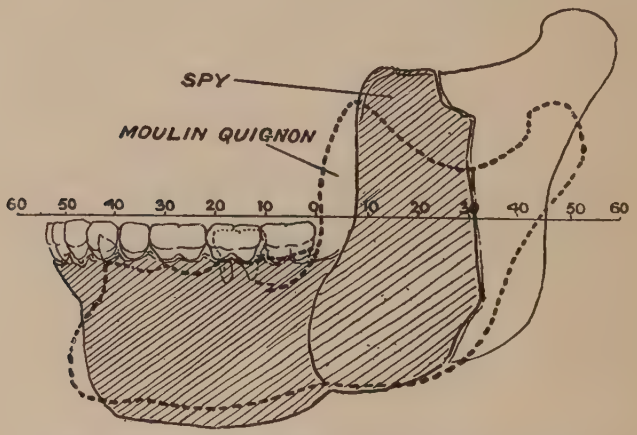

FIG. 97.—Stippled outline of the Moulin Quignon mandible superimposed on the Spy (Neanderthal) specimen.

of a Neanderthal man—one of the specimens found at Spy. It is at once apparent how different they are. The Neanderthal (Spy) specimen is by far the more simian, and if we did not know that men of the modern type must have been contemporaries of the Neanderthal species, we should never hesitate in accepting the Spy mandible as the true representative of Pleistocene man.

Were our predecessors right in rejecting the Abbeville mandible ? I think not. Boucher de Perthes gives the most circumstantial account of its discovery. There is not a single point mentioned by Busk or by Falconer which makes its antiquity impossible. It was almost an

[1] J. L. Rome, F.G.S., *The Abbeville Jaw*, Hull, 1864.

isolated case in 1863, but since then the discoveries at Galley Hill, at Bury St Edmunds, at Clichy, and at Grenelle have been made. Our predecessors were largely influenced by prejudice. We have seen how modern man, already fully evolved, appeared suddenly in Europe at the end of the Mousterian period. Was this his first appearance in Europe or was it a reappearance? Time will probably show that the pioneer of Abbeville was not only right about the human implements of the terraces, but also about the human remains. He died in 1868: it was not until 1908 that a statue was erected to him in Abbeville.

In our search for men of the most ancient Palæolithic periods, we now move from Abbeville on the estuary of the Somme to Paris on the banks of the Seine. The greater part of Paris is built on deposits—on terraces—laid down by the Seine. The river deposits of Paris offer certain advantages for our present purposes. Galley Hill and Abbeville lie in the tidal reach of their valleys. When submergence of the land sets in, the tidal reaches of the valley become filled up. Afterwards, as the land rises again, the deposits are scoured out. All that remains of these deposits are the fragments preserved as terraces on the sides of the valley. At Paris we are far enough above sea-level to safeguard the valley deposits; they may be disturbed in part, but at many places we may expect to find the very oldest deposits lying in their original condition on the lowest part of the valley. At Chelles, for instance, eight miles to the east of Paris, the ancient deposits, with typical specimens of the Chellean culture, rest on the floor of the valley of the Marne. These Chellean strata lie under others of the Acheulean period, and these in turn are surmounted by deposits of the Mousterian period. If ancient river deposits do contain human or other remains, there is no place where they were so likely to be discovered as in the foundations of Paris—for no area has been so extensively excavated.

In the year 1868 a gravel pit was still worked off the

Avenue de Clichy, right in the heart of that part of Paris which lies on the north bank of the Seine. The problem of man's antiquity was still being debated. On the 18th of April of that year—1868—M. Eugène Bertrand, then a student in Paris, visited, as was his wont, the gravel pit off the Avenue de Clichy to see what fossil bones had come to light. The remains of extinct Pleistocene mammals had been found from time to time. On that morning he was informed that the labourers had exposed a human skeleton on the working face of the pit. M. Bertrand was an expert observer and familiar with the strata of the pit. The depth at which the skeleton lay was 5·25 m. (17·3 feet) from the surface. It was embedded in the fourth layer from the top. Fig. 98, which shows the sequence of the overlying strata, is taken from a paper published by M. Rutot. M. Bertrand gave an account of his discovery to the Anthropological Society of Paris in the same year.[1] The antiquity and authenticity of the Clichy skeleton was accepted by all the authorities in France except one —M. G. de Mortillet, who believed that the workmen at the pit had deceived M. Bertrand. The clear-sighted Professor Hamy had no doubt as to any of the facts relating to the discovery. In his excellent treatise on Ancient Man [2] he records all the essential facts bearing on the authenticity of M. Bertrand's observations.

The same fate overtook the Clichy skeleton as the Abbeville jaw. With the acceptance of Neanderthal man as our Pleistocene ancestor, it was relegated to oblivion, and would probably have remained there had it not been for M. Rutot. M. Rutot has spent a lifetime in studying the river deposits of the valleys of Belgium. He is convinced that his observations of the valley deposits of Belgium may be applied to the valleys of the adjoining countries. He is certain that the terraces of the Seine at Paris must have been formed at the same time and in the same way as those in the valleys of the Meuse, of the

[1] *Bull. Soc. d'Anthrop.*, 1868, ser. 2, vol. iii. p. 329.

[2] *Précis de paléontologie humaine*, E. T. Hamy, Paris, 1870.

Thames, and of the Somme. In 1910 he visited Paris and verified his conclusions.[1] At Clichy he found the same deposits, in the same order as at Abbeville, as at St Acheul, and as at Galley Hill. Each stratum carried in it the corresponding Palæolithic culture. The skeleton at Clichy, he has proved, lay in a deposit which corresponds with the one in which the Galley Hill skeleton was

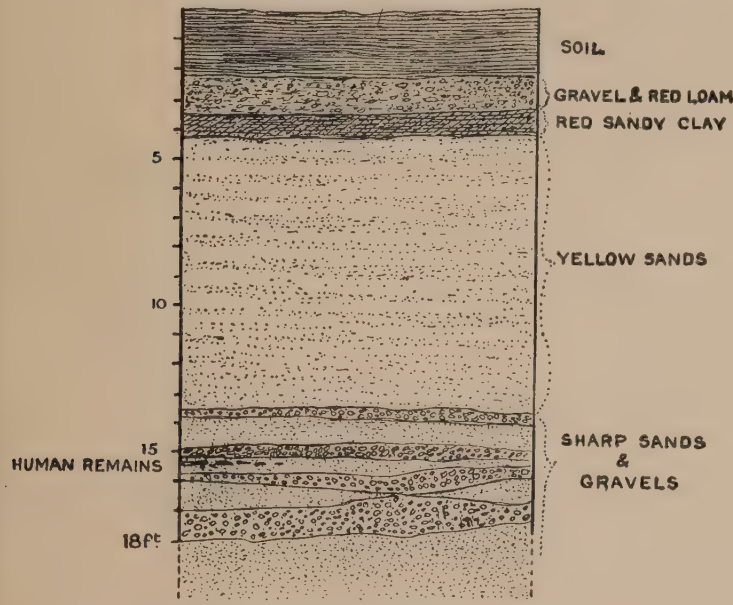

FIG. 98.—Strata of the gravel pit at Clichy, Paris. (After M. Rutot.)

embedded. At Galley Hill the human remains lay in the loam under the middle gravel, the stratum which contains palæoliths of the Chelles period. At Clichy the human skeleton lay in a grey loam with bands of gravel and of sand which at St Acheul contains the typical Chellean industry.

The discoveries at Clichy and at Galley Hill revealed very similar kinds of men. At Clichy parts of an entire skeleton were preserved; we have clearly to do with a

1 "Revision stratigraphiques des ossements humains quaternaires de l'Europe," *Bull. Soc. Belge de Géol.*, 1910, vol. xxiv. p. 123.

burial—one made probably from a Chellean land surface. As at Galley Hill, the individual found had a remarkably long head, 204 mm., with a width of 138 mm.—almost to a millimetre the length and width of the Galley Hill skull. Unfortunately, at Clichy the lower part of the forehead was broken away, but the bones of the vault have the same extreme thickness as those at Galley Hill—10 to 13 mm. The height of the vault above the ear-holes is almost the same—118 mm., a low roof for such a long skull. The ear-holes are wide and the mastoid process small—exactly as in the Galley Hill skull. On the other hand, there is a difference as regards the lower limbs. The Galley Hill tibia was not flattened from side to side; in the Clichy skeleton flattening was present. Both were persons of low stature. Can we suppose that the workmen at Galley Hill and at Clichy had a supernatural knowledge and implanted those two similar but peculiar varieties of men in the same geological stratum, and in the midst of the same ancient, Palæolithic culture? As regards size of brain, the Clichy man, judging from the measurements of the skull, should be about the same brain capacity as the Galley Hill man—under 1500 c.c.

I have cited only this one instance from the ancient valley deposits of Paris, because it is not necessary to prove more than one case—one instance of a modern type of man who lived before the Mousterian period, the heyday of Neanderthal man in Europe. At Grenelle, a suburb of Paris, on the south bank of the Seine, human remains of the same type have been found at an even greater depth, and others of a different type at more superficial horizons. There is no doubt that even in the earliest Palæolithic periods—one hundred thousand years ago or perhaps more—the culture and the people in the valley of the Seine and in the valley of the Thames were very much alike.

From Paris our present inquiry takes us along the valley of the Rhône towards the north of Italy. At Lyons it is well to break our journey and visit Le Puy, situated on the upper waters of the Loire in a moun-

tainous country to the north of the Cevennes. In the museum of the town is preserved the frontal bone of a human skull, which was found embedded in a volcanic matrix. The history of the specimen is well known. An account of it was published in 1844, but the fullest description is that given by Dr Sauvage in 1872.[1] In 1859, Sir Charles Lyell visited Le Puy, and examined the volcanic deposits on Mount Denise, where the specimen was found. The actual site of discovery is situated in a

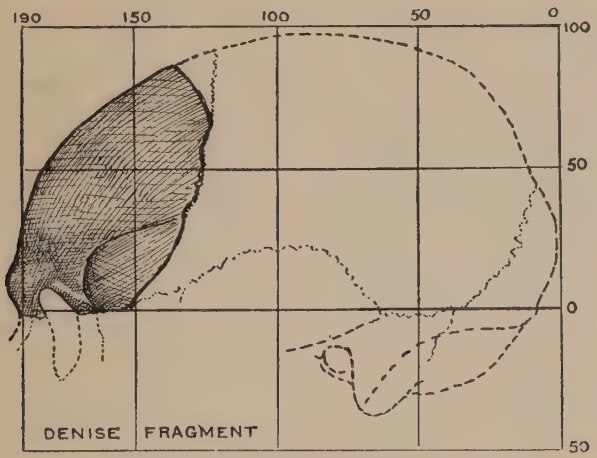

FIG. 99.—The Denise frontal bone.

vineyard terrace near the summit of a hill. The matrix in which the specimen is embedded guarantees its antiquity. The frontal bone is that of a person who lived before the last volcanic eruption which occurred in Central France. In the same deposit as the skull are found the remains of the cave-hyena and hippopotamus. The date of the eruption and of the skull is therefore mid-Pleistocene—about the same age as the Bury St Edmunds fragment. Perhaps it may be older. Its interest for us is that although so ancient it differs in no essential particular from the frontal bone of a modern skull (fig. 99). From its dimensions one infers that it

1 " L'homme fossile de Denise," *Rev. d'Anthrop.*, 1872, vol. i. p. 289.

formed part of a relatively small skull—yet one which was somewhat larger than the skull represented by the Bury St Edmunds fragment. The frontal bone is not thick, only 6·5 mm., and the supra-orbital ridges are not pronounced. From other features we infer the Denise skull was that of a young woman. Other bones of the human skeleton have also been found in the same volcanic deposit, but, unfortunately, to meet a demand on the part of visitors to Le Puy, many spurious specimens were offered for sale, thus throwing doubt on those which are undoubtedly genuine.

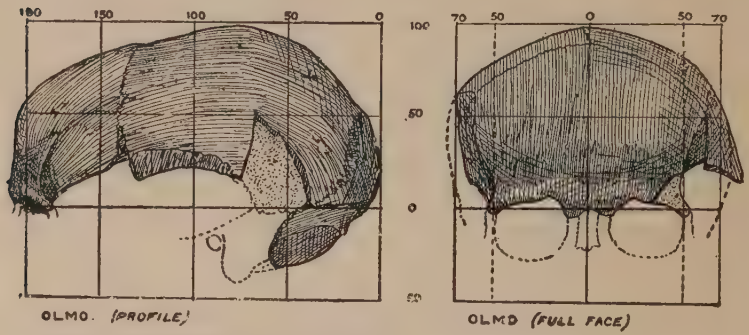

FIG. 100.—The Olmo cranium viewed from the side and from the front.

The final discovery I am to cite as evidence that the inhabitants of Europe in pre-Mousterian times were people, not of the Neanderthal, but of the modern type, is that made in 1863 by Signor Cocchi, Curator of the Museum of Geology in Florence.[1] In making the railway southwards from Arezzo, in the upper waters of the Arno, a cutting or trench over 50 feet deep had to be dug. During the excavation the Olmo skull was discovered (fig. 100). It lay at a depth of almost 50 feet (15 m.) beneath the surface, in a deep stratum of blue clay—a deposit formed in the floor of an ancient lake.

[1] " L'Uomo fossile nell' Italio Centrale," *Mem. dell. Soc. Ital. de Sc. Nat. Milan*, 1867, vol. ii., No. 7. Abstract in *Bull. Soc. d'Anthrop.*, 1868, ser. 2, vol. ii., p. 40. See also Professor Guiseppe Sergi, " Su l'uomo fossile dell' Olmo," *Revista di Antropologia*, 1917, vol. xxi. p. 3.

That the skull lay in this stratum there can be no doubt. It is still preserved in the Geological Museum of Florence, its cavity being filled—as when found—by a mass of the blue clay. Over the blue clay of the railway cutting were deposits—about 12 feet in thickness—which Cocchi regarded as of late Pleistocene and also of recent formation. The blue clay in which the skull was embedded he assigned to the older Pleistocene deposits. The remains of an elephant (*Elephas antiquus*, Sergi), and of

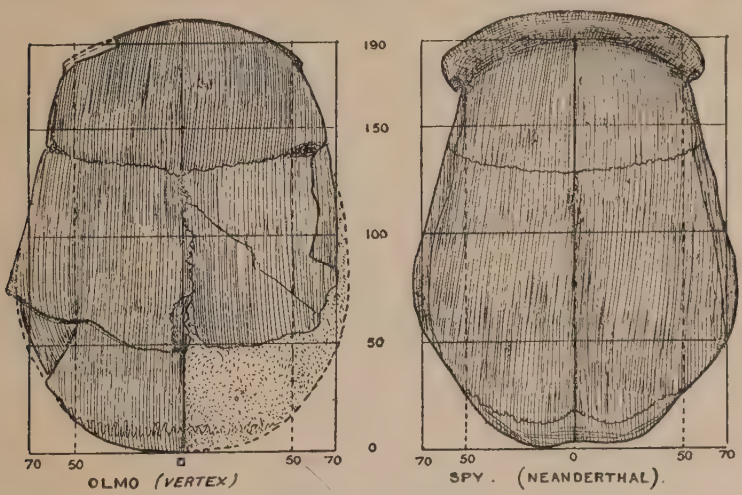

FIG. 101.—The Olmo cranium viewed from above, compared with a similar view of the vault of the Neanderthal calvaria.

an early form of Pleistocene horse (*Equus larteti*), occurred at the same horizon as the skull. Near the skull, charred wood marked the site of an ancient hearth. The culture of the period is represented by a Palæolithic implement which may well belong to the Chellean period. The exact cultural horizon to which the skull should be assigned cannot be fixed with any degree of certainty, but for our present purpose it is sufficient to be convinced that the skull is older than the period of Mousterian culture. Of that, I think, there can be no doubt.

The skull is clearly a variant of the modern type. My friend, Professor Sera, was good enough to obtain for me

an exact cast of the Olmo skull, and it is from this cast that the accompanying drawings have been made. When viewed in profile, the skull is seen to be of about the same length as the Galley Hill and Clichy specimens. Its length is 202 mm. ; its width is more difficult to estimate exactly, owing to some degree of distortion by earth-pressure, but it cannot have been less than 150 mm.—giving a head index of 74. The vault is low, about 116 mm. above the ear passages, and remarkably flat—a feature recalling the Bury St Edmunds fragment. As in that fragment, the frontal bone is sharply bent, producing a wide and vertical forehead. The brain capacity is estimated at 1560–1600 c.c.—a large and capacious skull. The forehead shows a smaller development of supra-orbital ridges than in the skulls of the more primitive of modern races. The width of the forehead, at the level of the upper margin of the orbits, is only 106 mm. ; the "minimal width," taken higher up on the forehead, has an ample dimension—namely 100 mm. On the other hand, the bones of the vault are remarkably thick—11 mm. There is not a single feature in this skull we can call simian. In this it agrees with other human skulls of great antiquity.

We have now completed a tour of Europe in search of pre-Mousterian man. The European of the Mousterian period—Neanderthal man—from an anatomist's point of view, was of a most primitive type. He possessed many features which are rightly regarded as ape-like. In the deposits of the two long periods which preceded the Mousterian—the Acheulean and Chellean, probably covering between them a stretch of almost one hundred thousand years—at least, the Thames filled up and scoured out its valley twice during that space of time—we have found no trace of Neanderthal man, nor of his ancestor. The deposits of the Thames, of the Somme, of the Seine, of the Arno, from one side of Europe to the other, have revealed the same story—the existence of a man, a mere variant of modern man, with a thick skull, a big brain, and a long head. How are we to account for this unexpected revelation ? There are two ways : we may hold

with the majority of anatomists and geologists, and simply refuse to believe in the authenticity of these discoveries because they run so contrary to our preconception of how and when modern man was evolved. Or, with Sergi and with Rutot, we may put our preconceptions aside, and, as we are bound to do, accept the revelations of those discoveries as facts, and alter our conception of man's evolution to harmonise with our facts. We have, in the first place, to conclude that man of the modern type is much older than we supposed. We expected to find him in a process of evolution during the Pleistocene period, but we have traversed more than the half of that period and find our own species much as we find him at the present day. It is clear we must seek for his evolution at an earlier time than the Pleistocene. Neanderthal man is a different and also, in many respects, but not in all, a very primitive species of man. Where and when he was evolved we shall have to discuss in connection with the Heidelberg jaw (p. 332), and with the remarkable African type, known as Rhodesian man (p. 382). As a result of recent discoveries we are compelled to take a more complex view of the world of ancient man. In our first youthful burst of Darwinianism we pictured human evolution as a simple procession of forms leading from ape to man. Each age, as it passed, transformed the men of the time one stage nearer to us—one more distant from the ape. The true picture is very different. We have to conceive an ancient world in which each region or area was sparsely occupied or inhabited by its own particular genus or type of mankind; these regional genera or types were in turn broken up into local species or varieties, just as we see to-day in the case of man's nearest surviving relatives—the anthropoid apes of Africa and of Farther Asia. Then out of that great welter of ancient human forms one species became dominant, and ultimately the sole surviving form—the species represented by the modern races of mankind. Such must be the working hypothesis which the anthropologist takes with him when he sets out to unravel the problems of man's evolution.

CHAPTER XIV

ANCIENT MAN IN EAST ANGLIA

When investigating the 100-foot terrace of the lower valley of the Thames, where the remains of Galley Hill man were found, note was made that the materials of the terrace represented deposits of three ages. There were, first, the uppermost and latest in which Acheulean implements were found; there were, in the second place, a middle series which yielded implements of the pure Chellean type; and thirdly, deepest and oldest of all, were those containing the mixed types to which, at present, the provisional name of pre-Chellean is given. In this chapter we are to carry our search for ancient man back into that vast and remote time which covers the evolution of pre-Chellean cultures. We have already committed ourselves to the statement that the beginning of the true Chellean culture may be placed at so distant a date as one hundred and thirty thousand years ago. To take us to the beginning of the Pleistocene period we cannot allow more than an additional seventy thousand years; even then, as we shall see, the beginning of the pre-Chelles stone-culture is not reached (see fig. 264).

In this chapter we are to leave the lower valley of the Thames, where we have traced the footsteps of prehistoric Englishmen far into the past, to prosecute our search in the three eastern counties of England—Norfolk, Suffolk, and Essex, which we may speak of as East Anglia. This part of England is comparatively low and flat, a tableland scored into valleys by streams which run eastwards to the North Sea and westwards to the Great

Ouse and Wash. Over it, we shall find a thick mantle of glacial deposits, particularly the well-known sheet of chalky boulder clay. Underneath its glacial mantle, lie a series of deposits which were laid down at that period of the earth's history which saw man rising to his present state of body and of brain. Although in 1863, when Sir Charles Lyell wrote the first edition of his *Antiquity of Man*, not any trace of man had been recognised in the deposits of East Anglia, yet his unerring judgment led him to give utterance to the following forecast : " Neither need we despair of one day meeting with the signs of Man's existence in the Cromer forest bed (see fig. 103), or in the overlying deposits, on the ground of any incongeniality of the climate, or incongruity in the state of the animate creation with the well-being of our species." Mr J. Reid Moir, who has done more than any man to justify the great geologist's foresight, has lately written : " There is, perhaps, no other area known to archæologists, richer in the remains of prehistoric, flint-using man than that of East Anglia in England." [1] It is in these deposits of East Anglia we are now to seek for traces of pre-Chellean man.

Ere setting out on our excursion it will be helpful to discuss certain matters relating to the geological deposits of East Anglia before actually leaving the lower valley of the Thames. Here we have been dealing with deposits laid down by the river on the sides of its valley at various times, and the reader may think that the geological formation, represented by the broad lands of East Anglia, belongs to a totally different order. The valley of the Thames is, however, but a small side extension of that much greater valley which is now filled with the waters of the North Sea. There have been times when the North Sea valley has become dry land, and along its floor there flowed, in a northerly direction, the ancient Rhine, receiving the Thames as a minor tributary.

[1] *The Great Flint Implements of Cromer, Norfolk.* Ipswich: W. E. Harrison, 1923.

So recently as early Neolithic times (fig. 102) the delta of the ancient Rhine lay out in the North Sea, near where the Dogger Bank now is. The southern shores of the

FIG. 102.—The shores of the North Sea in late Palæolithic and early Neolithic times.

North Sea extended then from Yorkshire to Denmark. The state of things seen in early Neolithic times was but a repetition of land and sea movements which have several times chequered the history of the North Sea. One particular phase of land-elevation marked the dawn of the Pleistocene period. The ancient Rhine, meandering

down the North Sea valley, would behave as rivers do; as the land rose it would deepen its valley, leaving parts of its ancient bed as terraces on the valley flanks. As the land fell it would tend to fill its valley with fresh deposits. We cannot, unfortunately, examine the lower and more recent terraces laid down along this valley, for they lie to-day under the waters of the North Sea, but the older and higher terraces we can investigate, for we find them forming the lands of East Anglia. In reality a great part of East Anglia represents a high terrace of the North Sea valley—a vast terrace of the Pliocene period, covered by glacial deposits of the Pleistocene. This ancient East Anglian terrace, like that represented at the 50-foot level of the Thames valley, is made up of two totally different formations. In the deeper parts of the 50-foot terrace we find gravels and sands—remnants of the ancient river bed; over these are loams and brick earths, in which implements of the Mousterian and of later Palæolithic cultures are found; these are glacial deposits of a much later date than the gravels underneath. Similarly in East Anglia we find the older deposits covered by a great mantle of clays, loams, brick earths, sands, and gravels, laid down when the climate of England was sub-Arctic in character. The components of this glacial mantle we shall have to enumerate presently, but in the meantime we must give our attention to the deeper and older deposits which lie under the glacial mantle because it is in them that Mr Reid Moir and his colleagues are discovering most definite evidence of man's high antiquity.

In fig. 103 is reproduced a conspectus of the deposits of East Anglia given by Mr Reid Moir.[1] If we compare the deposits thus represented with those of the 50-foot terrace of the Thames valley, then all those which are above the Arctic fresh-water beds must be compared to the glacial deposits on the terrace—the loams, brick earths, and Coombe rock, which carry implements of Mousterian and post-Mousterian date—while the older

[1] *The Great Flint Implements of Cromer*, p. 13, fig. 2.

deposits, from the Cromerian forest beds above to the Coralline Crag below, may be compared to the deep gravels and sands—the essential constituents of the

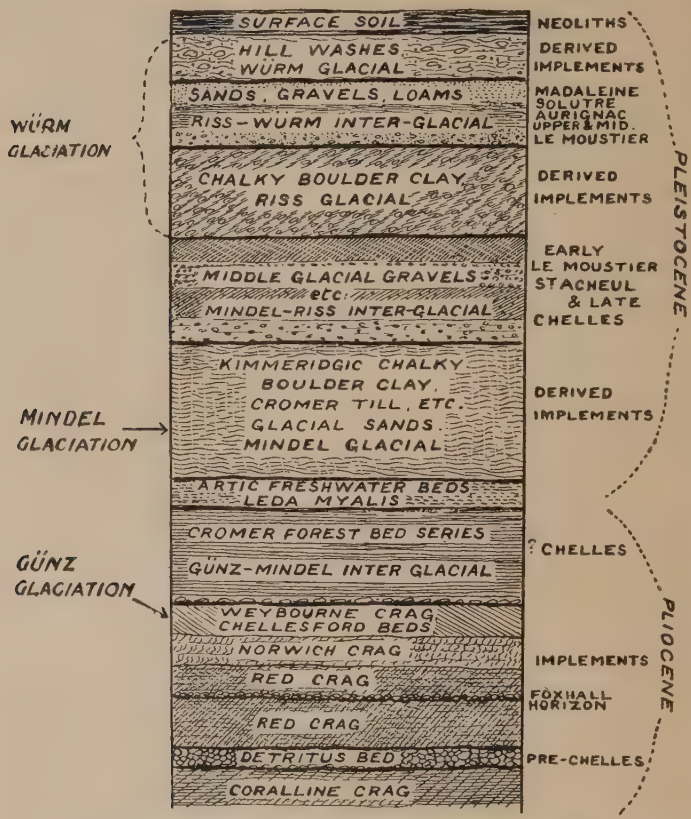

FIG. 103.—The Pliocene and Pleistocene deposits of East Anglia, grouped and superimposed in the order—or supposed order—of age. (After Reid Moir.) On the left-hand side of Mr Moir's diagram I have introduced the system of nomenclature adopted in this book. Three glaciations are recognised: Würmian, Mindelian, and Günzian.

terraces found in the Thames valley at the 50-foot and 100-foot level. Our interest for the present moment is centred in these older and deeper deposits of East Anglia; to understand the significance of the discoveries which are being made in them, we must have a mental picture of

the manner in which they have been laid down. When we look at what is taking place in the North Sea to-day—and we can judge of the past only by observing what happens in the present—we see that the Rhine, the Thames, and other rivers which pour their waters into the upper end of the North Sea valley, are depositing the scourings of their watersheds at their mouths. Every year these rivers have to carry their burdens just a little farther before depositing them, thus tending to fill up the upper or south end of the North Sea valley. In the Pliocene period a somewhat similar process must have been in operation. In fig. 103 the deposits of this period—from the Coralline Crag below to the Arctic fresh-water beds above—are represented as if they were superimposed vertically on one another; in reality, they are arranged in an overlapping manner, much like slates on a roof, the series beginning in the south, with the deepest and oldest, the Coralline Crag, and ending in the north with the uppermost and most recent—the Cromer forest beds. It is plain that the formation of such extensive deposits must have occupied a very long span of time, yet it is on and under one of the deeper deposits—the Red Crag—that Mr Reid Moir has found flint implements worked by the hand of Pliocene man.

There is another process at work, tending to fill up the North Sea valley, with which visitors to the soft, sludgy cliffs which form the shore-line of East Anglia are already familiar. The sea is steadily eating into East Anglia, gnawing it away; fields, woods, houses, villages, churches, and graveyards, which fifty years ago seemed remote from danger, are now in process of demolition, by the merciless action of tides and storms. The cliffs and shorelands, made up of the strata shown in fig. 103, are being sluiced away, and their materials swept seawards by tide and current become incorporated as a component part of the present beach and sea bottom. A visitor to these shores sees a Crag being slowly formed under his eyes. Into the beach or Crag are swept the various strata of the cliffs. In the strata thus commingled on the beach

there lie cultures of various ages—cultures which link our present civilisation to the rude life of Pliocene man. We must be prepared to find a mixture of cultures in Crag deposits. Were the North Sea valley once more to become dry land, the beach which now fringes the shore of East Anglia would then appear as a terrace—a terrace skirting the brow of the North Sea valley. This introduction may assist the reader to understand how a "detritus bed" comes to underlie the Red Crag, and why this bed should contain fossil bones and flint implements belonging to very different geological epochs.

Having thus given a brief homily on the geological deposits [1] of East Anglia, we now go forward to seek for the remains of Chellean and pre-Chellean man in the heart of this country, and, failing the discovery of his actual bones, to trace man backwards into the Pliocene period by means of his implements.

In our search for Acheulean man (Chapter XII) we have already noted on the coast of Essex a fragment of a terrace corresponding to the one at the 100-foot level of the Thames valley, and the deposits in the valley of the Gipping near Ipswich which were explored by Miss Layard and are probably of Mousterian date. Then, on the edge of the plateau, to the east of Ipswich, mention

[1] For readers who wish to consult authoritative writings the following references will be of service :—

Professor P. F. G. Boswell.—"The Geology of the Country round Cromer and Norwich," *Proc. Geol. Assoc.*, 1923, vol. xxxiv. p. 207. See also *Journ. Roy. Anthrop. Inst.*, 1923, vol. liii. p. 229.

Professor J. E. Marr.—"Man and the Ice Age," *Proc. Prehist. Soc. East Anglia*, 1920, vol. iii. p. 177. See also *ibid.*, 1920, vol. iii. p. 353.

Mr A. S. Kennard.—"Pleistocene Succession in England," *Proc. Prehist. Soc. East Anglia*, 1916, vol. ii. p. 249.

Mr F. W. Harmer.—*The Glacial Geology of Norfolk and Suffolk*, Norwich, 1910.

Mr W. B. Wright.—*The Quaternary Ice Age*, London, 1914.

Dr Henry F. Osborn.—"Pliocene and Early Pleistocene Animals in East Anglia," *Geol. Mag.*, 1922, vol. lix. p. 433.

Dr Henry F. Osborn and Chester A. Reeds.—"Old and New Standards in Pleistocene Division in Relationship to the Prehistory of Man in Europe," *Bull. Geol. Soc. America*, 1922, vol. xxxiii. pp. 411-490.

has been made of the brick earths explored by Professor Boswell and Mr Reid Moir ; they found that these earths contained an orderly sequence of implements belonging to the Mousterian and Acheulean periods. We have also visited the brick-earth pit near Bury St Edmunds where a fragment of a human skull was found, and have made a cursory journey to the brick-earth deposits at Hoxne (see fig. 85, p. 236) where so long ago as 1797 John Frere gathered Acheulean flints, regarding them as ancient "spearheads." We have come back to this classical spot on a definite errand—to settle what relationship that great glacial mantle—the chalky boulder clay—bears to the various cultures of Palæolithic man. A

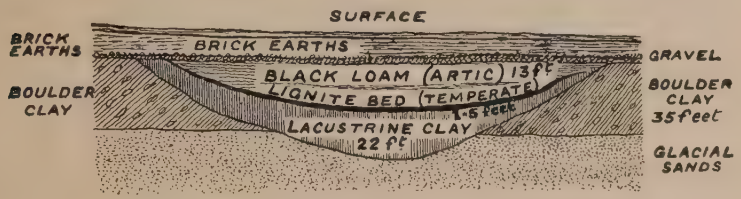

FIG. 104.—A diagrammatic section of the deposits of the Glacial period at Hoxne.

section of the strata at Hoxne, which are reproduced in a diagrammatic manner in fig. 104, seem to give us a most decisive answer. This section shows an old valley which has been filled up with the following deposits, enumerating them from the most recent at the top to the older at the bottom. First come the brick earths some 7 feet in depth, containing sharp-edged unrolled flints worked in the Acheulean manner. In this brick earth also occur Mousterian implements (Reid Moir). Then under the brick earth occurs an older deposit, a black brick earth, 13 feet in depth and containing leaves of plants which thrive under sub-Arctic conditions, but which yields no trace of man. Then under the black earth the still older lignite bed, 1 to 3 feet in thickness, containing a flora indicating a temperate climate, very similar to that which now holds for East England. Under the lignite bed lie 22 feet of lacustrine clay, the material which first silted up

the ancient valley and blocked its stream. Neither from the clay nor from the lignite bed over it has any trace of man been found. A glance at the section (fig. 104) makes clear that all these deposits were formed long after the sheet of chalky boulder clay, here some 35 feet in thickness, had been laid down, for the valley itself has been cut in the chalky boulder clay and the stream which carved it has actually deepened its floor until the glacial sands, which lie under the boulder clay, have been reached and excavated. We have here the most definite evidence that the deposition of the chalky boulder clay and the glaciation which gave rise to it, were ancient history long before Acheulean man appeared at Hoxne. From the time at which Acheulean man left his implements in the upper brick earths of the valley to that at which the chalky boulder clay was deposited on the glacial sands, there had taken place a series of events which involves the passage of a very long period of time. The temperate and Arctic deposits of the valley indicate very clearly that a climatic cycle intervened between the deposition of the brick earths, with their Acheulean implements and glaciation, which gave rise to the mantle of chalky boulder clay. This glacial landmark of East Anglia seems therefore to be much older than these deposits in the 100-foot terrace of the Thames valley, which yield implements of the Acheulean and typical Chellean forms. If, then, we were to find human remains under this great stratum of glacial boulder clay, they should be much older than those found at Galley Hill or elsewhere in the 100-foot terrace.

This belief was held by all British geologists in 1911, when, in October of that year, Mr Reid Moir announced the discovery of the Ipswich skeleton; it lay under a thin but intact extension of the great stratum of chalky boulder clay, which covers so large a part of the Suffolk plateau. As will be seen in the sequel, Mr Reid Moir and the writer no longer claim such a high antiquity for the Ipswich skeleton. And the reader may therefore expect me to consign its discovery to the limbo of forgotten

things. I am of a different opinion; it often happens that we learn more from mistakes than we do from successes, and this is certainly true from the Ipswich find. Elsewhere [1] are told the circumstances which led to the uncovering of this famous skeleton in Bolton and Laughlin's gravel pit, in and near which Mr Reid Moir made discoveries of lasting importance; here we shall touch on the problems which were raised by the finding of the skeleton, and the manner in which these were finally settled. The accompanying sketches, figs. 105 and 106, will make clear the site of the discovery and the geological surroundings of the skeleton.

Ipswich is situated in the valley of the Gipping—ten miles from the open sea. As has already been mentioned, there occur on the floor and sides of the valley the same terrace and the same deposits as in the valley of the Thames. Passing northwards through Ipswich the traveller soon leaves the town and the valley and finds himself on a plateau, about 150 feet above the level of the sea, and covered everywhere by a thick stratum of chalky boulder clay, varying in depth from 15 to 25 feet. The plateau slopes gently to the west until it reaches the brim of the valley of the Gipping—or rather a side recess of the main valley. Messrs Bolton and Laughlin's brick-field is situated on the edge of this minor valley —the surface level of the plateau at this spot being 129 feet O.D.

At the brick-field the chalky boulder clay has become reduced to a stratum of about 4 feet in thickness (see figs. 105, 106). In parts it is "weathered"—the chalk and clay being altered in composition and appearance by exposure. That the stratum at the brick-field represents a direct extension of the great sheet of boulder clay, Mr Moir proved by sinking a series of pits from the brick-field to the crown of the plateau. In the map prepared by the officers of the Geological Survey the chalky boulder clay is shown to extend to the pit.

1 *Journ. Roy. Anthrop. Instit.*, 1912, vol. xlii. p. 345. Also the first edition (1915) of this work, p. 214.

The antiquity of the Ipswich skeleton depended on the proof of two things: (1) that the stratum which lay over the skeleton was truly a part of the great sheet of chalky boulder clay, laid down during the period of maximum glaciation; (2) that it was absolutely intact

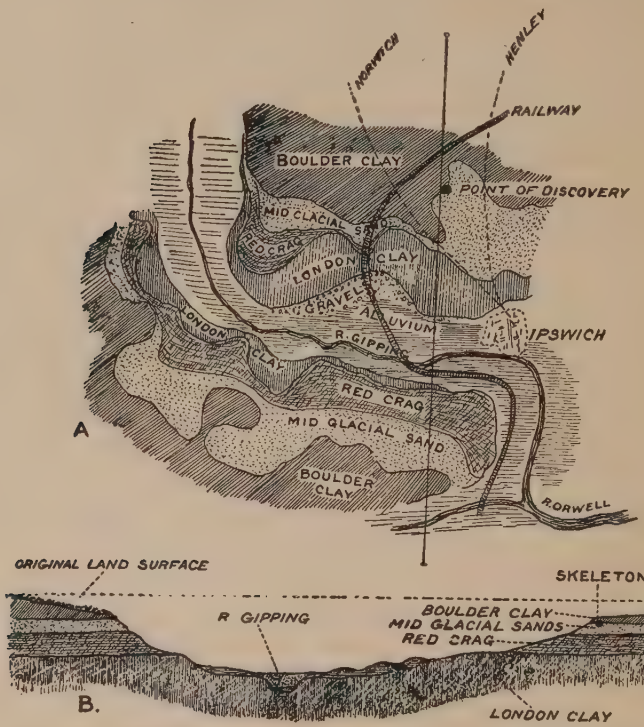

FIG. 105.—Sketch of the valley of the Gipping to show the locality in which the Ipswich skeleton was found.

FIG. 106.—Sketch of a section across the Gipping valley to show the horizon of the discovery (the line of section is shown in 105).

and undisturbed since the time of its deposition. Mr Moir was keenly alive to the fact that a skeleton found at a depth of 4½ feet (1·38 m.) was, unless convincing evidence to the contrary could be produced, most probably placed there by a gravedigger's spade. He therefore took every means of verifying the unbroken and undisturbed nature of the stratum in and under which

the skeleton lay, for it was embedded between the weathered boulder clay above and the mid-glacial sands below (fig. 106). He and those who worked with him satisfied themselves that the overlying stratum was continuous and unbroken. We have already seen the measures he took to prove the continuity of the stratum with the main sheet of chalky boulder clay.

We then turned to the skeleton itself to see what evidence could be obtained of its antiquity by a close examination of its state of preservation and of its structure. When the blocks of matrix containing the fragmentary remains of the skeleton came to the museum of the Royal College of Surgeons, we set to work and slowly dissected away the boulder clay, leaving the fragments implanted on a matrix of glacial sands. By placing the blocks together it was easy to reconstruct the original posture of the skeleton. From fig. 107 it will be seen that a whole skeleton was represented, and that it was placed on the right side in the ultra-contracted posture. We have already discussed the significance which is usually attached to the discovery of a complete human skeleton, with all the parts in their natural position. The most reasonable explanation is to suppose that it has been placed where found by burial. In this case, unfortunately, we have no clear idea of the conditions under which the chalky boulder clay was deposited—whether in deep water or on an old land surface. If, as Mr Moir supposes, it was laid down on an old land surface, then it is possible that the burial was made from that surface. At least it was not made from the present land surface, for the overlying stratum was intact. The contracted posture scarcely helps us in fixing a date. Contracted burials occur at all periods—Neolithic and Palæolithic.

Nothing was found with or near the skeleton to give a clue to date. If the conditions were such as to secure the preservation of a human skeleton, it is also probable that remains of animals of the same period should be preserved in the same stratum. At the horizon at which the human skeleton lay no animal remains have been

found at Bolton and Laughlin's pit. In the glacial sands, however, bones of Pleistocene animals occur, and in many cases the condition of these bones is very similar

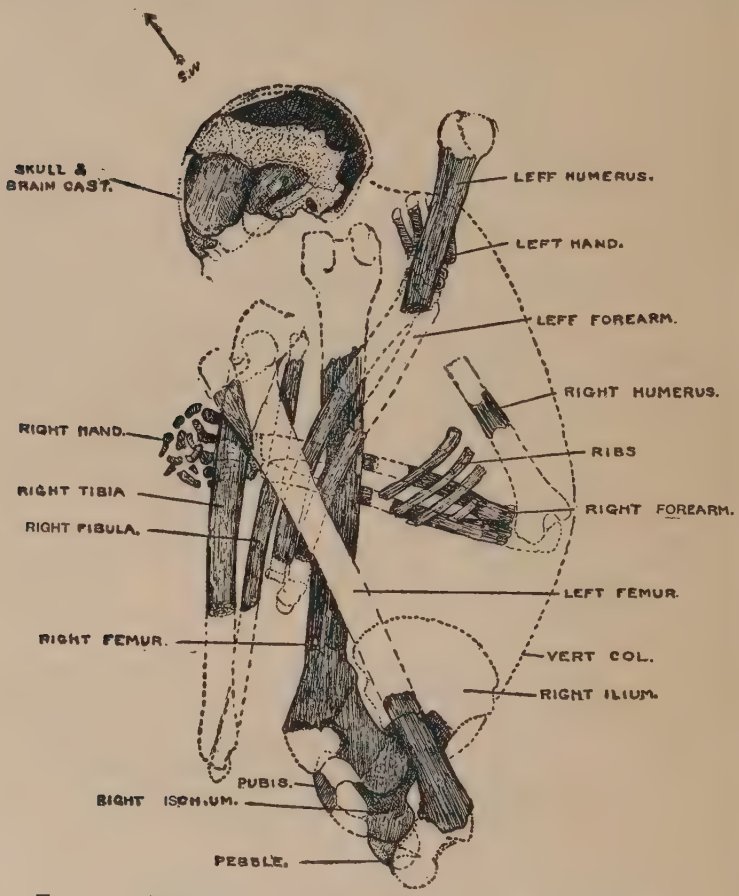

FIG. 107.—The parts of the Ipswich skeleton replaced in position.

in their state of preservation to the bones of the Ipswich skeleton. The substance of the bones is grey and chalky in appearance, crumbling to a white dry dust on pressure. The bones, when dissolved in hydrochloric acid, leave no animal matrix behind. No stone implements of any kind were found with the skeleton. Whether or not the

Ipswich man represents an inhabitant of East Anglia prior to the deposition of the chalky boulder clay, there is no doubt, as we shall see presently, that men were then in this part of England; and in the opinion of those who have studied the works of their hands and brains, they were workmen who showed a considerable knowledge of flint fracture.

The Ipswich skeleton represents a tall man, 5 feet $10\frac{3}{4}$ inches (1·800 m.) in height. The cavity of the skull was filled with a sandy, chalky loam, giving a fairly accurate cast of the brain which had at one time occupied

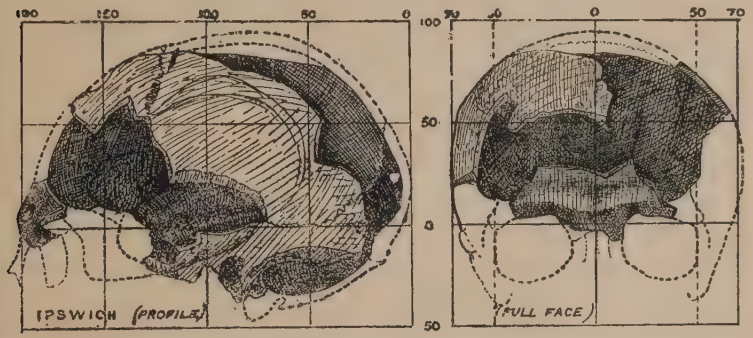

FIG. 108.—Drawings of the Ipswich skull from the side and from the front.

the space. The skull itself was much broken, but it was possible to reconstruct the main features of the head. The brain capacity for so tall a man is only 1430 c.c. All the characters of the skull are those we are familiar with in modern man. The characters we associate with Neanderthal man were absent. The forehead was retreating, and the supra-orbital ridges were pronounced, but of the divided modern type. When viewed from the side and from the front (fig. 108), the skull fits comfortably within the frame designed for modern English skulls. The maximum length is 192 mm., about the same as in an average modern Englishman. Its width is 144 mm., slightly beyond the modern average, giving a cephalic index of 75. The vault is flat on the top and also remarkably low, only 111 mm.—characters reminding

us of the Bury St Edmunds fragment which belongs to a time long after the deposition of the chalky boulder clay.

The characteristic mark of the Ipswich man lay in his tibia or shin bone. No human tibia of a similar shape has ever been described before, and after a prolonged search I have been unable to find any specimen which resembles it either in ancient or modern man, in health or in disease. As regards the Ipswich tibia, there is no sign of inflammation, nor is there any reason to attribute its

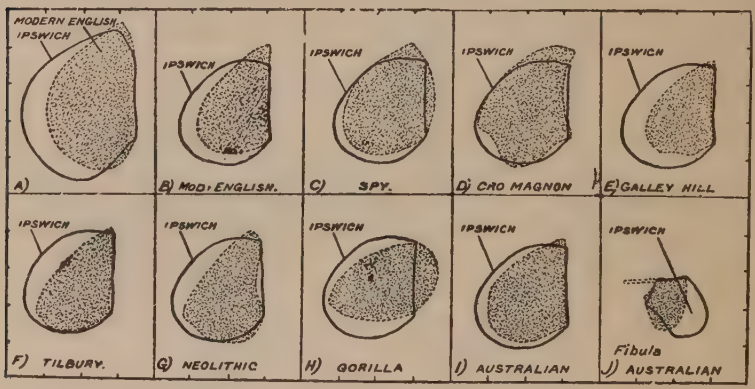

FIG. 109.—Sections across a series of tibiæ of various races. A. A section across a modern English tibia at the junction of upper third with lower two-thirds, compared with similar section of the Ipswich tibia. The others represent sections at the mid-point of the tibia, except the last, which represents a section of the fibula.

peculiar features to either a freak of growth or to an individual peculiarity. I expect it to prove a character of the race.

To give a clear idea of the peculiar characters of the Ipswich tibia, I reproduce in fig. 109 a series of sections across the tibiæ of various races of men, giving with each an outline section of the Ipswich tibia.[1]

The peculiar feature of the Ipswich tibia is the absence of the sharp, bony crest, which can be felt in all modern bones, descending on the front of the leg, just under the skin. In place of a sharp crest there is a flat, anterior surface. Although the absence of this sharp crest is a

[1] For full description of skeleton, see reference, p. 293.

simian character, yet the Ipswich tibia cannot be said to resemble the same bone of anthropoid apes (fig. 109, H), whereas the tibia of Neanderthal man does show a distinct approach to the anthropoid form (fig. 109, C). In the Ipswich man the tibia is the opposite of the platycnemic leg bone of Neolithic races, in which there is a side-to-side flattening (see fig. 109, G). In the Ipswich specimen, the flattening is from front to back. The functional meaning of this peculiar character I cannot explain; I look upon it, like the teeth of Neanderthal man, as a form of specialisation, the functional significance of both characters being unknown. The Ipswich fibula, too, is of a peculiar form (fig. 109, J). The femur shows none of the flattening in its upper third which is so frequently present in Neolithic races.

Mr Moir and the writer were well aware that the discovery of human remains so near the surface, so destitute of all characters of a primitive or ape-like nature, could not carry the conviction of a skeleton found at a depth which places its antiquity beyond dispute. If, however, the Ipswich skeleton had shown characters as distinctive as those of Neanderthal man, or as those of the Piltdown man—found at a depth of a little over 3 feet below the surface—would anyone have doubted that its age was older than the deposition of the boulder clay? I do not think the age would then have been called in question. But under the presumption that the modern type of man is also modern in origin, a degree of high antiquity is denied to such specimens. It is, therefore, all the more important that every discovery of human remains, made in circumstances which make their high antiquity a reasonable presumption, should be placed on record, with no fact kept back and none put forward that is not fully proven.

Our account of the Ipswich discovery was published in 1912. Its site, as we have seen, was on the brow of the valley in which Bolton and Laughlin have their sand-pit. The strata to be seen in this pit may be identified in fig. 106. Above, there is the stratum of chalky boulder

clay; then follow glacial sands; deeper still comes the shelly sandy Red Crag, here over 20 feet in thickness. The position of these strata in the geological formation of East Anglia will be realised by a glance at fig. 103; there it will be seen that the Red Crag belongs to the upper or more recent of the Pliocene deposits. Some day, I hope, Mr Reid Moir will tell the story of how he came to search and re-search the "detritus bed" under the Red Crag (fig. 103) of this sand-pit for flints shaped by man to serve as implements and tools, and how his search was ultimately crowned by success in 1910.[1]

After the finding of the Ipswich skeleton, in order to throw more light on its history, Mr Moir began to concentrate his attention on the implements found in the more superficial strata of the side valley and of the neighbourhood. He discovered, as we have already seen (p. 153), buried "floors" carrying implements and remains of the Aurignacian and of the Mousterian period of culture. He carried his investigations to the brow of the valley and found, at about the same level or horizon as that occupied by the skeleton, there were scanty remains of an ancient floor—"probably referable to the early Aurignacian period." As a result of this discovery he announced in *Nature* (12th October 1916) that the Ipswich skeleton "was referable to a late Palæolithic epoch," and that it was no longer possible to claim for it a "pre-chalky boulder clay antiquity." In this way the Ipswich man fell from his high antiquity to take a humble place among men of the Aurignacian period.

[1] For further details, see p. 307 of this book.

CHAPTER XV

ANCIENT MAN IN EAST ANGLIA (*continued*)

The Problems of Glacial Chronology

Having thus displaced the Ipswich skeleton from its high estate, Mr Reid Moir turned his attention to the contents of the chalky boulder clay—and surprised himself, as well as other experts, by finding in it flints chipped in the early Mousterian manner.[1] This must not be taken to mean that man lived in Suffolk as the chalky boulder clay was being deposited; it signifies that the great ice-sheet, which gave rise to the clay, was formed on a land surface where early Mousterian man had lived and left his tools. Mr Moir was alive to the crux in which this discovery placed him. He was well aware of the section at Hoxne (fig. 104), which shows as clearly as can be, that a great sheet of chalky boulder clay had been deposited not only long before the Mousterian, but also long before the Acheulean culture had appeared in England. Investigation carried out by Professor Boswell and himself [2] led them to the conclusion that there are two sheets of chalky boulder clay, an upper and a lower, of very different ages. The upper and the later was formed in the glacial epoch which set in not long after the Mousterian culture was introduced into England, while the other belongs to an older glacial period—the one which set in when the Chellean culture was still in an early stage of its evolution, for in the glacial sands which underlie this deeper boulder clay Mr Reid Moir finds traces of the workmanship of early Chellean man.[3]

[1] *Journ. Roy. Anthrop. Instit.*, 1920, vol. l. p. 135.
[2] *Ibid.*, 1923, vol. liii. p. 229.
[3] *Ibid.*, 1919, vol. xlix. p. 74.

Up to this point we have alluded to glacial episodes in only a passing manner. There has come about a sad confusion in the naming of them.[1] The deeper chalky boulder clay is assigned by Mr Reid Moir (see fig. 103, p. 288) to what Professor Penck named the "Mindel" glaciation, but by others, including M. Boule, is named "Riss." The upper boulder clay is assigned (fig. 103) to the "Riss," but it corresponds to the "Würm" of M. Boule. Then over the brick earths containing Mousterian and Aurignacian implements we find contorted drifts—represented by the upper Coombe rock of the Thames valley deposits—the product of the final glacial episode—one which reached its climax at the end of the Palæolithic culture. This final cold period represents the "Würm" glaciation of some authorities; for others it is but the concluding episode of the preceding glaciation. Thus we have, in the strata just enumerated (see fig. 103), evidence of three periods of glaciation, which, from their cultural relationships, may be named "Early Chellean," "Mousterian," and "Magdalenian."

It is clear, I think, that the two last named—the

[1] Amongst those who have sought to harmonise the naming of glacial episodes are the following:—

Mr M. C. Burkitt.—*Proc. Prehist. Soc. East Anglia*, 1920, vol. iii. p. 311. See also his valuable work, *Prehistory*, Cambridge, 1920.

Mr H. J. E. Peake.—*Man*, 1922, vol. xxii. p. 6.

Mr S. Hazzeldine Warren.—*Proc. Geol. Assoc.*, 1st February 1924.

Here it may be helpful if I reproduce the estimates which Dr Henry Fairfield Osborn has given (*Men of the Old Stone Age*, 1916) of the duration of glacial and interglacial stages:—

I. Günz (Late Pliocene)	25,000 years.
(1st Interglacial)	75,000 "
II. Mindel (Early Pleistocene)	25,000 "
(2nd Interglacial)	200,000 "
III. Riss (Pleistocene)	25,000 "
(3rd Interglacial)	100,000 "
IV. Würm (Late Pleistocene)	25,000 "
(Post-glacial)	25,000 "
	500,000 years.

Mousterian and Magdalenian—are episodes of one glaciation—the second of the two Pleistocene, and as this is becoming universally recognised by the name "Würm," I have adopted it here. For the first Pleistocene glaciation, the one which led to the deposition of the deep boulder clay, and apparently occurred at an early phase of the Chellean culture, I use the name "Mindel," thus omitting altogether the use of "Riss." Günz is the name used for the Pliocene glaciation (see fig. 103). Thus I proceed on the assumption that in unravelling the prehistory of man we have to take three glacial periods into consideration—Günzian, Mindelian, and Würmian. But we shall see that in the opinion of certain authorities [1] all of the deposits we have enumerated—deep boulder clay, upper boulder clay, and contorted drift—should be assigned to a single period of glaciation.

We have been searching the glacial deposits of East Anglia for traces of ancient man; we are now to turn our attention to the Cromer forest beds, which are deeper and older deposits. In some places they may measure as much as 50 feet or even 70 feet in thickness. They were laid down in the estuary of the great river which flowed down the North Sea valley—the ancient Rhine—the climate of Europe being then milder than it now is. These Cromer beds are of the utmost importance for our present inquiry, for they bring us to the brink of the Pliocene period; the accepted opinion amongst British geologists is that they were laid down in the closing part of the Pliocene period. If we find implements within these deposits, then we shall be dealing with the handiwork of late Pliocene man.

In fig. 110, taken from Sir Charles Lyell's first edition of *Antiquity of Man* (1863), is represented a section of the shore cliffs a few miles to the east of Cromer, the cliff being here about 35 feet in height. Over the Cromerian deposits, named "forest" and "upper" beds in fig. 110, lies a thick sheet of the deeper boulder clay, which, as in the section at Hoxne, is seen to have been excavated by a

[1] See references to Holst and Kennard on p. 310.

stream ; the valley thus formed has become filled up with deposits of later Pleistocene date. In this section the Cromerian beds tell us of the mild climate of the last phase of the Pliocene period ; the overlying boulder clay brings forcibly before us the Arctic conditions which set in early in the Pleistocene period. We realise the transition from temperate to Arctic conditions more fully if we turn to fig. 103, where it will be seen that certain beds — the *Leda Myalis* and *Arctic fresh water* — are interposed between the Cromerian beds and the deep chalky boulder clay. Nowhere else in the world is there more striking evidence of change of climate.

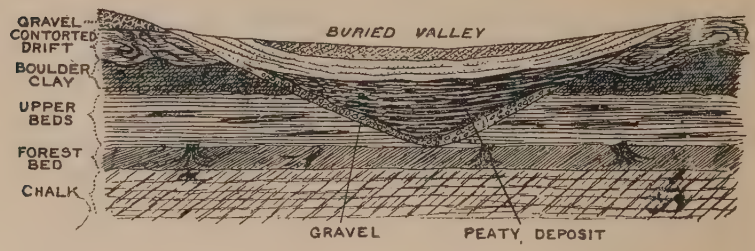

FIG. 110.—Section of the Pleistocene deposits near Cromer, Norfolk (Sir Charles Lyell).

The section of the cliff, shown in fig. 110, represents the Cromerian beds as resting on chalk, but at more favourable sites, as depicted in fig. 103, they are seen to succeed two older deposits—the Weybourne Crag and Chillesford beds. Now in these two beds there is contained evidence which tells us that they were laid down when cold conditions prevailed. Thus the Cromerian beds represent deposits formed in a long (the first) interglacial epoch between a late Pliocene glaciation (the first or "Günz" of Penck), and an early Pleistocene glaciation (the second or "Mindel"). Then, underlying the Chillesford beds come the Norwich Crag and the Red Crag (fig. 103), the climate growing more genial as we follow these strata backwards in order of deposition.

We have seen that Sir Charles Lyell was of opinion that traces of man would be found in deposits as ancient

as the Cromer beds. Before the nineteenth century was out his prophecy came true. In 1897, Mr Lewis Abbott discovered flints showing unmistakable signs of human workmanship in the "elephant" stratum of the Cromer deposits.[1] In 1911, Dr W. L. H. Duckworth[2] made a similar find. As early as 1905, Mr W. G. Clarke[3] had observed "eoliths" in the stone bed under the Norwich Crag. Mr Reid Moir,[4] who has made a close study of such flakes and implements as have been gathered from the Cromer beds, is of opinion that this source will yet yield definite evidence of Chellean man. Although these beds yield abundantly the fossilised remains of animals, belonging to species which, for the greater part, are now extinct, yet, up to the present, they have not yielded a single bone of the ancient Cromerians.

In 1920, Mr Moir discovered a "working floor," a site used for the knapping of flint implements by early Cromerians, under the following circumstances.[5] On the foreshore, immediately to the west of Cromer, he observed an area covered with flints, which, from their nature and colour, he recognised as being derived from sub-Cromerian beds in the adjoining cliff. Amongst these scattered rough flint boulders were some which were clearly worked in an "early" Chellean manner. Most of them were of great size, there being specimens which weighed as much as 22 lbs. I reproduce in fig. 111 the section which Mr Moir has given of the cliff at Cromer to show the horizon at which he believes the ancient work-floor occurs. At this point of section (fig. 111) the cliff is nearly 100 feet in height, the greater part being

[1] W. J. Lewis Abbott, "Worked Flints from the Cromer Beds," *Natural Science*, 1897, vol. x. p. 89. See also *Proc. Prehist. Soc. East Anglia*, 1919, vol. iii. p. 110.

[2] W. L. H. Duckworth, *Cambridge Antiquarian Society Communications*, 1911, vol. xv. p. 156.

[3] W. G. Clarke, *Proc. Prehist. Soc. East Anglia*, 1912, vol. i. p. 160.

[4] J. Reid Moir, *Proc. Prehist. Soc. East Anglia*, 1920, vol. iii. p. 21. See also *The Great Flint Implements of Cromer*, 1923.

[5] *The Great Flint Implements of Cromer*, Ipswich, 1923. See also *Journ. Roy. Anthrop. Instit.*, 1921, vol. li. p. 385.

composed of a glacial deposit—the contorted drift. Under this drift lies the Cromer bed series; Mr Moir traces the implements to an ancient land surface, or level lying under the Cromer forest beds, and they are, therefore, pre-Cromerian in date. Mr Moir, however, is very willing to admit that the "term Chellean, when applied to flint implements, is very elastic," and that it is possible that what he has named "early Chellean" others might call "pre-Chellean." However this may be, the fact remains that man had attained a certain degree of skill—a high degree—before the deposition of

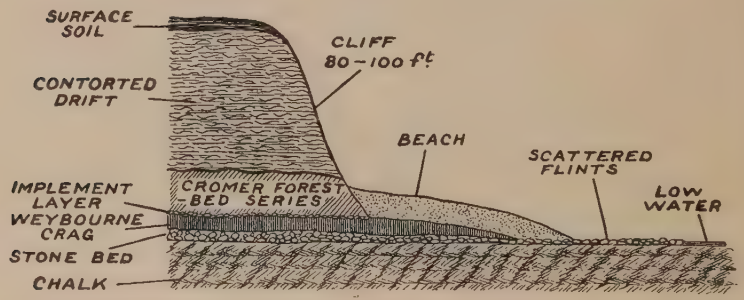

FIG. 111.—Section of the cliff and foreshore at Cromer, on which is indicated the level of the early Chellean "floor." (After Reid Moir.)

even the forest beds of Cromer, beds which carry fossil remains of Pliocene animals. Further, authorities of the standing of Mr A. S. Kennard [1] and Mr A. C. Hinton,[2] who have devoted themselves to a study of the Pleistocene fauna of England, are convinced that the Cromer forest beds are older than the deposits found in the 100-foot terrace of the Thames valley.

We are now to leave the cliffs of the Cromer coast, where we have been following man by his implements backwards to the later deposits of the Pliocene period, and retracing our steps towards Ipswich, we shall now follow the ancients of East Anglia into a still more remote past. About four miles to the east of Ipswich, and

[1] *Proc. Prehist. Soc. East Anglia*, 1916, vol. ii. p. 249.
[2] *Proc. Geol. Assoc.*, 1907, vol. xx. p. 53.

situated 70 feet above sea-level, is Foxhall pit, now disused, but worked in former years for coprolites—fossil bones and other remains of ancient animals. Coprolites were ground to a powder and used by farmers as a manure. It was in this pit that the Foxhall mandible was found (see p. 273). In 1917, Mr Reid Moir [1] again laid bare the strata of the

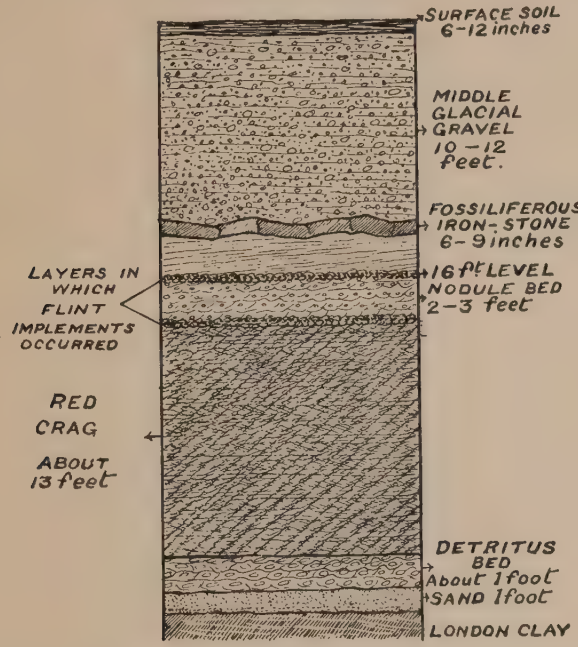

FIG. 112.—A diagrammatic section of the deposits revealed in the western face of the Foxhall coprolite pit. (After Reid Moir.)

pit to study their order, nature, and contents. He has given a section of its deposits, here reproduced as fig. 112. Under the surface soil are 12 feet of glacial sands—which underlie the deeper stratum of chalky boulder clay. Under the glacial sands come the shelly sands of the Red Crag. We have seen (p. 289) that the North Sea is now busily engaged in pounding East Anglia into a "Crag." The Red Crag is all that is left of the fair lands of East

1 *Proc. Prehist. Soc. East Anglia*, 1921, vol. iii. p. 389.

Anglia when the North Sea of Pliocene times had done with it. In the upper part of the Red Crag, at the 16-foot level (see fig. 112), Mr Moir encountered two levels at which coprolites occurred. At these levels he succeeded in finding definitely worked flint implements. They are implements of a kind which may be named "pre-Chellean"; in Mr Moir's opinion, they represent types out of which have been evolved implements of the fully developed Chellean culture. The occurrence of a floor of implements on the foreshore at Cromer permits us to understand how implements of a still earlier period may come to be embedded in the upper strata of the Red Crag. Then under the Red Crag of the Foxhall pit, as represented in fig. 112, there occurs the famous sub-Crag "detritus bed"—the sweepings of an ancient land-surface. The "detritus bed" is well developed in Bolton and Laughlin's pit at Ipswich, and it was while searching this bed in 1909 and 1910 [1] that Mr Moir discovered evidence of early man's handiwork. The "sub-Crag" culture of the detritus bed yields flint tools of several kinds and ages, the predominant and characteristic type being known as "Rostro-Carinates." It is clear, then, that England was already inhabited by early man before the sea began to pound East Anglia into the Pliocene compound known to geologists as Red Crag.

When the first edition of this book was being written in the early months of 1914, the drama of Boucher de Perthes was being acted over again in England. All the men who then held a position of high authority in the world of science received Mr Reid Moir's announcements with incredulity, all save Sir E. Ray Lankester,[2] whose powerful advocacy forced a speedier recognition of the truth than fell to the lot of the great Frenchman. In this instance, as is so often the case in England, it was the amateur who led the advance guard. Mr Moir had to

[1] *Proc. Prehist. Soc. East Anglia*, 1911, vol. i. p. 17. See also *Pre-Palæolithic Man*, Ipswich, 1921.

[2] *Proc. Roy. Soc.*, 16th November 1911; *Special Publication Roy. Anthrop. Instit.*, 1914.

steal from his business the time he gave to explore the deposits of East Anglia in search of ancient man. His struggle to have the truth of his discoveries recognised may be said to have ended in 1922, when a Commission [1] of French and Belgian experts visited the scenes of his labours and acknowledged that the detritus bed under the Red Crag did indeed contain flints which had been shaped by human hands. It is given but to few men to add a chapter to man's early history—a chapter which covers several hundred thousand years. But of the men of this distant past we know nothing save their flint implements.

As early as 1905, Mr W. G. Clarke [2] had observed "eoliths" in the stone bed under the Norwich Crag. Since then Mr Clarke has collected a series of worked flints representing an "industry" of a later date than Mr Moir's series which come from under the Red Crag. Thus it will be seen that recent discoveries in East Anglia carry the history of man in England to beyond the bounds of the Pleistocene epoch—well into the Pliocene period. We shall see that M. Rutot, before these discoveries were made in East Anglia, had already classified the "industries" represented in the Pliocene deposits of the Continent.

The antiquity represented by the sub-Crag flints cannot be calculated with any degree of accuracy. Geologists assign to the Pliocene period a duration of over a million years. Estimates of the Pleistocene period, as we shall see in another chapter, vary from one hundred thousand years to one million five hundred thousand years. The more I become familiar with the evidence relating to this period, the more my judgment is drawn towards the lower estimates. The scale employed in preceding chapters allows for some two hundred thousand years to cover the Pleistocene period. If this allowance is accepted; then it would not be unreasonable to allow an

[1] "Les Silex d'Ipswich," *Revue Anthrop.*, 1923, vol. xxxiii. p. 1.

[2] *Proc. Prehist. Soc. East Anglia*, 1912, vol. v. p. 160; *ibid.*, 1916, vol. ii. p. 213.

almost equal period to take us back to the time of sub-Crag man.

Thus we are supposing that over three hundred thousand or four hundred thousand years ago there were men and women living in East Anglia who had already attained a considerable skill in shaping flints to serve as tools. Nor do the sub-Crag implements represent mere first attempts. We shall see, when we come to deal with Piltdown man, that the "eoliths" which Mr Benjamin Harrison gathered on the Kentish plateau as long ago as 1885, are more primitive and older than the sub-Crag rostro-carinates.[1]

It may be well now, before quitting the geological records of East Anglia, to obtain as clear a conception as is possible of what geologists mean by the "Ice age." Many English geologists [2] maintain that, so far as our country is concerned, there is evidence of only one period of glaciation—that the deep chalky boulder clay seen in section at Hoxne and the contorted brick earths which cover the later Palæolithic implements are deposits of a single glaciation. This is Mr Kennard's [3] opinion, and it is also one which has been urged recently by Dr Nils Holst,[4] who holds the opinion that the deep chalky boulder clay was laid down about twenty-two thousand years ago. To get at the truth of this matter we have to go outside England to the clearly cut records to be found in the lower valleys of the Alps and of the Pyrenees. The late Professor James Geikie [5] gave a lifetime and a very sound judgment to a study of the glacial deposits of Europe, and by 1894 had reached the conclusion that

[1] Rev. H. G. O. Kendall, "Middle Glacial and Pre-Crag Implements in South Norfolk," *Proc. Prehist. Soc. East Anglia*, 1915, vol. ii. p. 31; *ibid.*, 1921, vol. iii. p. 333.

[2] See literature and summary given by Mr W. B. Wright, *The Quaternary Ice Age*, London, 1914.

[3] *Proc. Prehist. Soc. East Anglia*, 1916, vol. ii. p. 249.

[4] *Geol. Mag.*, 1919, vol. ii. pp. 418, 434, 504; *L'Anthrop.*, 1917, vol. xxviii. p. 291.

[5] *The Great Ice Age*, 3rd edition, 1894. See also his *Antiquity of Man in Europe*, Edinburgh, 1914.

there was convincing evidence of four periods of glaciation, separated by three temperate or interglacial epochs. In 1903, Professor Penck[1] of Berlin published the results of his investigation. He, too, came to the conclusion that there had been four main glaciations with three interglacial intervals. The names which he gave to these periods—"Günz,"[2] "Mindel," "Riss," "Würm"—have been preferred to those given by the Scottish professor. When we seek for identifications of these four glaciations in the strata of East Anglia, we must assign the "cold" beds under the Cromerian series (see fig. 103, p. 288) to the "Günz" or late Pliocene glaciation—one which falls between the sub-Crag culture and the pre-Chellean of the Cromer beds. Then to the "Mindel" or early Pleistocene glaciation we assign the Arctic deposits which lie immediately over the Cromer beds—the Cromer Till, deep chalky boulder clay and glacial sands. After the "Mindel" glaciation came the long interval which saw the full evolution of the Chellean culture, the Acheulean in all its variations, and the early Mousterian. The brick earths which carry Acheulean and Mousterian floors we know; they seem to fall into the latter part of this, the second interglacial period; the deposits of the earlier part, containing the Chellean culture, are not known in East Anglia—unless Mr Reid Moir is right in regarding Chellean culture as being as old as the Cromerian beds. Then to the earlier or Mousterian phase of the third glaciation we assign the Coombe rock of the Thames and the upper chalky boulder clay with associated deposits, and to its later or Magdalenian phase the brick earths and Arctic beds which overlie Mousterian and in some cases Aurignacian floors.[3] We have to admit that the geological book, represented by the deposits of East Anglia, although the best available for our present purpose, is still a sadly mangled volume, one in which

1 "Das Alter des Menschengeschlechtes," *Zeitschrift für Ethnologie*, 1908, vol. xl. p. 390.

2 See p. 302 of this book.

3 For reference to literature, see p. 290 of this book.

there are chapters missing and others very defective. The same may be said of the terrace deposits of the Thames. And yet a study of flint cultures bids fair to unravel the order and age of these imperfect geological records.

Glacial phases serve the student of ancient man as a series of milestones to mark his journey into the past. Unfortunately we do not know the circumstances which cause the ice-sheets which permanently cover polar lands and seas, to slowly extend their territories, to creep over and overwhelm lands which formerly had been fair and temperate. Nor do we know why a maximum is reached, followed by a slow retreat of the ice-sheet. We are not certain whether the machinery [1] involved is purely terrestrial, purely celestial, or a combination of the two. Ten years ago, when writing the first edition of this book, I was drawn towards a celestial machinery—that which was set out by the late Major-General Drayson [2] and which is now so warmly advocated by Major R. A. Marriott.[3] Since then have appeared the publications of Professor Ch. Depéret [4] of the University of Lyons. He has shown that glaciations are accompanied or preceded by changes in land and sea-level. He found, in the first place, that the terraces on the sides of river valleys, such as we have been studying in the Thames valley, are related to periods of glaciation; in the second place, he found that the terraces of river valleys are continued as raised beaches on the shores of adjacent seas—round the Mediterranean and up the western shores of Europe. This must mean that glaciation is accompanied by, or

[1] As to the cause or causes of glacial periods, readers are referred to *The Evolution of Climate*, by Mr C. E. P. Brooks (London, 1922).

[2] *The Earth's Past History*, 1888.

[3] *Changes in the Climate*, London, 1914; *Warmer Winters and the Earth's Tilt* (Exeter, 1921).

[4] The works of Professor Depéret and also of General de Lamothe have been recently summarised by Professor W. J. Sollas, *Nature*, 30th December 1922. See also Professor Sollas's *Ancient Hunters*, third edition, 1924. Professor Depéret's papers on the "Co-ordination of the Quaternary Periods" are in *Comptes Rendus*, 1918, vols. clxvi., clxvii.; 1919, vol. clxviii.; 1920, vol. clxx.; 1922, vol. clxxiv.

preceded by, a change in sea level, land level, or of both. If the theory put forward by Professor A. E. H. Love of Oxford University in 1907 [1] is really valid we should have an approximate explanation of events. He holds that the rotating earth seeks continually, but unsuccessfully, to reach a state of equilibrium. In its attempts the waters of the oceans tend at one time to be heaped towards the Equator, at other times towards the poles. The polar diameter of the earth tends at one time to lengthen and at another to shorten, thus altering the contour of the earth's crust, particularly of regions lying in higher latitudes. Such a theory does help us to understand how river terraces and raised sea beaches have come into existence. Further, the inquiries of Mr C. E. P. Brooks [2] assist us to perceive how changes in the distribution of sea and land—which must come about as a result of alterations in sea and land levels—can give rise to glacial conditions, independently of any change in the orbit or axis of the earth.

[1] *Phil. Trans.*, Series A, 1907, vol. ccvii. p. 171.
[2] *The Evolution of Climate*, 1922.

CHAPTER XVI

HEIDELBERG MAN

In this chapter we set out from England to make our last tour of Europe in search of the remains of ancient man. On our former journey (Chapter XIII) attention was directed to such remains as could be ascribed to men of the Acheulean and Chellean periods. On the present occasion we are in search of human remains belonging to a still earlier part of the Pleistocene period—to the very earliest part of that epoch, which, as we have just seen, is represented in East Anglia by the deposits of glacial sands and boulder clay. On such a quest our steps are naturally directed to Belgium, because of the labours and discoveries of M. Rutot, Conservator of the Royal Museum of Natural History in Brussels. He has spent a lifetime in the study of the various deposits which have accumulated in the valleys of Belgium—particularly in the industrial southern part of that country, where the valleys have been carved out and filled up by streams flowing eastwards to join the Meuse. In fig. 113, I reproduce a schematic section by M. Rutot, which gives in brief the conclusions he has reached concerning the number and the order of the deposits laid down in the valley floors of Belgium during the Pleistocene period.[1] From the adjoining diagram (fig. 113) it will be seen that M. Rutot recognises five series of strata in these deposits; but for

[1] See the following papers by M. Rutot: "Glaciations et humanité," *Bull. Soc. Belge de Géol.*, 1910, vol. xxiv. p. 59. "Revision stratigraphique des ossements humains quaternaires," *ibid.*, 1910, vol. xxiv. p. 123. "L'âge de la mâchoire humaine de Mauer," *ibid.*, 1908, vol. xxiii. p. 117.

our present purpose we need only direct attention to three of these. In the deepest and oldest series of all—lower Pleistocene series—occurs a thick bed of clay to which M. Rutot attaches particular importance, and names "glaise moseen," indicated simply as "clay" in fig. 113. This stratum he regards as marking the great floods which followed the break-up of the first and

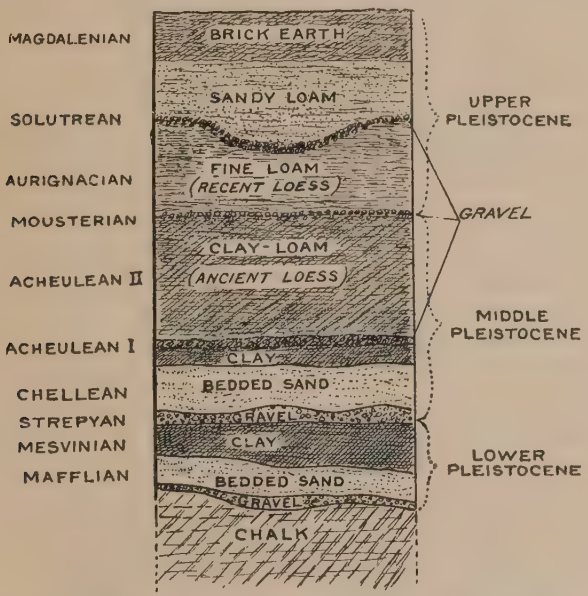

FIG. 113.—M. Rutot's schematic section showing the number and sequence of the strata in the valley deposits of Belgium.

probably the most severe of the Pleistocene ice ages—the "Mindelian." The deep chalky boulder clay of East Anglia is also looked upon as a product of the same glaciation.

The second of the strata in M. Rutot's section which demands our attention is a mixture of fine sand and clay—"ancient loess" or "limon gris"—a deposit which, in M. Rutot's opinion, was laid down during the floods following the "Rissian" or second Pleistocene glaciation. The ancient loess was certainly in process of formation

during the period of Acheulean culture, for it contains implements of this culture (fig. 113). The upper loam of the 100-foot terrace in the valley of the Thames (see fig. 83, p. 227) appears to correspond in time and circumstance to the ancient loess. The Bury St Edmunds cranial fragment finds its place in this horizon of M. Rutot's scheme. Lastly, in the upper and final strata of his scheme, M. Rutot recognises in the brick earths and loams the deposits which followed the third and last of the Pleistocene ice ages—the "Würmian." In such deposits are found the implements of the two final Palæolithic cultures—the Solutrean and Magdalenian. The strata of brick earths which covered the skeleton in the low terrace at Halling may be correlated with the final deposits of M. Rutot's scheme. M. Rutot's observations and conclusions have a very direct bearing on the inquiry we now have on hand, for he has shown that his scheme holds true, not only for Belgium, but is also applicable to the valley deposits of the Rhine, the Somme, the Seine, and apparently also to those of the Thames valley.

In fig. 113 there is set down opposite each stratum the kind of "flint culture" yielded by it. Under the bedded sand which is here marked as the level of the Chellean culture, lie three deeper and older beds which contain peculiar and primitive kinds of worked flints. To these M. Rutot gave, in descending order, the names "Strepyan," "Mesvinian," and "Mafflian"—believing all of them to be eolithic or pre-Chellean in character. In 1919[1] he instituted a close comparison between these Belgian deposits and the corresponding strata of the low (50-foot) terrace of the Somme valley at Amiens, so accurately investigated by the late Professor Commont, and found an exact correspondence. But the stratum which yields a "Mafflian" culture in Belgium carries a full Chellean culture at Amiens, and the strata which carry "Mesvinian" and "Strepyan" correspond with the lower

[1] M. Rutot, "Le Quaternaire du Nord de la France et de la Belgique," *Bull. de la Soc. Belge de Géol.*, 1920, vol. xxix. pp. 31, 151.

and middle Acheulean strata of France. He therefore infers that in early Pleistocene times the river valleys of Belgium were occupied by a people whose culture lagged far behind that of their contemporaries of the Somme valley. In brief, M. Rutot now admits that the Chellean culture extends to the very base of the low terraces of river valleys.

One other observation of M. Rutot, with an important bearing on our present inquiry, is reproduced in fig. 114.

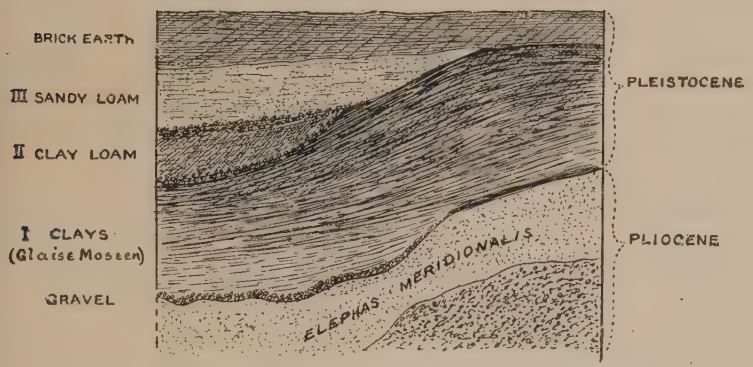

FIG. 114.—Section of the middle (100-foot) terrace at St Prest, near Chartres.

The figure reproduces M. Rutot's section of the famous gravel deposits at St Prest, situated in the valley of the Eure, a tributary of the Seine, about fifty miles to the south-west of Paris. The deposits at St Prest represent those of the 100-foot terrace — M. Rutot's middle terrace of river valleys. The section at St Prest is of particular interest because here the Pleistocene deposits of the terrace rest directly on formations of a late Pliocene date. It was in the deep Pliocene gravels of St Prest, containing remains of a Pliocene elephant (*Elephas meridionalis*), that M. J. Desnoyers [2] found, in 1863, the bones of extinct animals

[2] M. J. Desnoyers, *Comptes Rendus*, 1863, vol. lvi. pp. 1073, 1199. E. T. Hamy, *Précis paléontologie humaine*, Paris, 1870. M. G. Gourty, "Les Dépôts de St Prest," *Bull. Soc. d'Anthrop.*, 1913, ser. 6, vol. iv. p. 6.

showing clear signs of having been cut or hacked by man (see p. 511). Four years later, M. Bourgeois found in the same Pliocene gravels, flint implements representing the last of the Pliocene cultures—to which M. Rutot has given the name "St Prestien." Over the Pliocene strata at St Prest, M. Rutot recognises the usual Pleistocene deposits of the 100-foot terrace—particularly the "glaise moseen" (fig. 114). At the horizon represented by the junction of the Pliocene and the Pleistocene deposit of the 100-foot terrace M. Rutot recognised traces of an early Pleistocene culture, which may be assigned to the pre-Chellean series. The Cromer forest beds are regarded as of the same age as the deep gravels of St Prest. Under the Cromer beds, as we have seen (p. 306), Mr Reid Moir found an early Chellean floor.

Having thus surveyed the early Pleistocene deposits of Belgium and of Northern France through the eyes of M. Rutot, and the phases of human workmanship which he has detected in them, our next step is to seek for the remains of the men who lived when such valley deposits were being formed. At the present time only one specimen is available—the famous Heidelberg mandible. The mandible was found in the deepest strata of a valley deposit, lying six miles to the south-east of Heidelberg (fig. 37, p. 105). That old University town is situated on the Neckar, ten miles above its junction with the Rhine at Mannheim. Above Heidelberg, the Neckar is joined by the Elsenz, a stream flowing northwards along a shallow valley, and through a rich, agricultural country. On the eastern side of the valley, fully four miles above the junction of the Elsenz with the Neckar, is the rural village of Mauer. Close by the village is the sand-pit of Mauer—also on the eastern side of the Elsenz valley. Opposite the pit, the bottom of the valley stands 134 m. (440 feet) above the level of the North Sea, and 260 miles distant from the mouth of the Rhine. On the side of the valley, where the great sand-pit has been dug, the land rises 85 feet above the bottom of the valley, but so extensively and so deeply has the pit been worked that

its floor has almost reached the level of the bed of the present stream. The working face of the sand-pit has a total depth of 25 m. (82 feet). From these circumstances we may conclude that we are dealing with a river deposit —one which corresponds with the 50-foot terrace of the Thames valley.

For a long time the Mauer pit has been closely studied by geologists on account of its clear representation of Pleistocene deposits, and because of the extinct fauna preserved in its deeper strata. No site in Europe, it was realised, was more likely to yield the bones of early Pleistocene man than the sand-pit at Mauer. No one was more fully alive to this possibility than Dr Otto Schoetensack, Lecturer on Geology in the University of Heidelberg. Half an hour's journey by rail took him to the pit almost daily. After waiting and searching for twenty years, the owner of the pit, Herr J. Rösch, was able to inform him, on 21st October 1907, that the object of his twenty years' search had at last been realised. "Yesterday," he wrote, "the desired evidence was obtained, for 20 m. below the surface soil, and above the floor of my sand-pit, there was found the lower jaw of primitive man, in good preservation, and with all its teeth." In the following year, 1908, Dr Schoetensack prepared and published a monograph on the lower jaw of *Homo heidelbergensis*, which in exactness, directness, and fullness will always serve as an example for future discoverers of prehistoric remains.[1]

Before discussing the anatomical characters of the Heidelberg mandible, it is necessary to see what light may be obtained on its antiquity. Concerning the authenticity of the find there cannot be any doubt; the bed in which the mandible lay was covered by a series of deposits, amounting in all to 78 feet. In the deposits over the mandible Dr Schoetensack recognised twenty-four different strata. They fall into three series: (1)

[1] *Der Unterkiefer des Homo heidelbergensis: Ein Beitrag zur Palaeontologie des Menschen*, von Otto Schoetensack, Leipzig, 1908. Dr Schoetensack died in 1913.

the uppermost, formed by recent loess (fig. 115, D), a fine earth, a product of floods and drought; (2) the ancient loess (fig. 115, C), a sandy loam, also a deposit from muddy waters; (3) the Mauer sands (fig. 115, A, A, B, B). In one of the lower strata of this series the mandible was found. In the lower strata, remains of the following extinct animals were found:—the lion (*Felis leo fossilis*), an extinct form of cat, a dog (*Canis neschersensis*), two forms of bear, a species of bison, an early Pleistocene form of horse, an early form of rhinoceros (*R. etruscus*), and an elephant (*E. antiquus*). From this fauna, Dr Schoetensack concluded that the Mauer sands correspond in date of formation "to the preglacial forest beds of Norfolk." If Dr Schoetensack's opinion is right, then we ought to find the English contemporary of the Heidelberg man in those Cromerian beds which lie under the chalky boulder clay of East Anglia. Under the Cromerian beds, as we have already noted (p. 306), Mr Reid Moir discovered an early Chellean work-floor.

By a different process of reasoning, M. Rutot reached the same conclusion as Dr Schoetensack. M. Rutot had no implements from the Mauer pit to help him in dating the strata; it is a remarkable fact that the sands which have given us the most primitive human jaw yet found on the continent of Europe, have yielded not a trace of man's handiwork. In dating the strata of the Mauer pit, and in assigning to each series its probable cultural level, M. Rutot had to depend on the order and composition of the various beds. The sands at Mauer represent a valley deposit corresponding exactly to those he has studied in Belgium, both in age and in manner of formation. In fig. 115, I reproduce a diagrammatic section of the strata in the sand-pit at Mauer, as interpreted by M. Rutot in 1914; a later interpretation (1919) is given in fig. 116. The stratum of recent loess, over 18 feet in depth—the uppermost of the Mauer pit—represents, in M. Rutot's scheme, the débris of the last Ice age (Würm). The underlying strata of ancient loess, over 17 feet in depth, are, in his opinion, the product of the third glaciation (Riss),

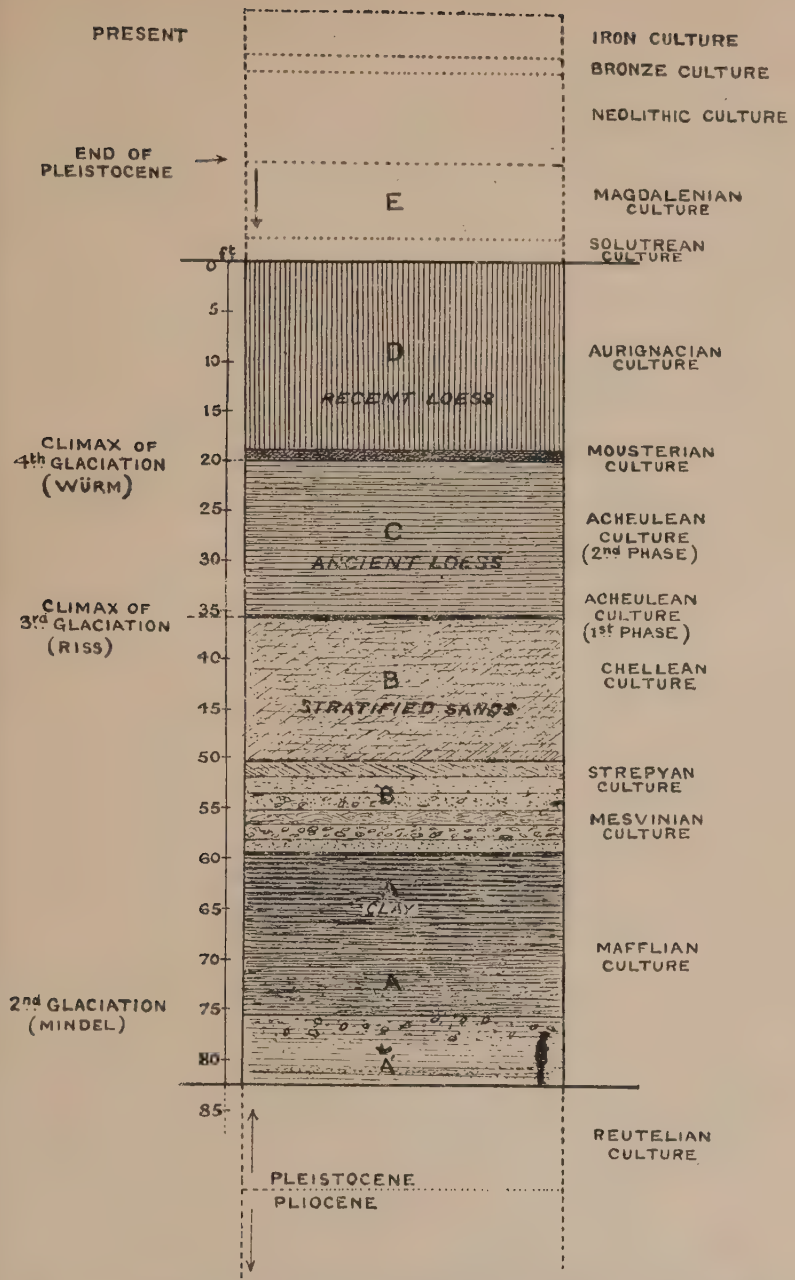

FIG. 115.—Diagrammatic section of the sand-pit at Mauer, showing the depth at which the mandible (A′) was found. M. Rutot's interpretation of the cultural levels (1914). To be compared with fig. 116.

Although no traces of human culture were found in the stratum of recent loess at Mauer, there can be no doubt, for the following reasons, that its deposition belongs to the later Palæolithic periods. Along the valleys of the Rhine and of the Danube the deposits of recent loess are known to yield implements belonging to the Aurignacian culture. In the same regions, representations of the Mousterian period are found under the recent loess, but above the ancient loess. The latter deposit corresponds to the "limon gris" of Belgium and France, and in this deposit occur implements of the Acheulean period.

Near the middle horizon in the stratified series of Mauer sands are thick beds of clay and sandy clay, nearly 13 feet in total depth, which M. Rutot identifies with the "glaise moseen" (A, A in fig. 115), and these he regards as deposits of the great floods which marked the close of the second and greatest of the glaciations (Mindel). The human mandible lay 10 feet below the clay bed at Mauer, in sands corresponding to the basal beds of the low terraces of Belgium, where M. Rutot found his Mafflian industry (see fig. 115). We have seen, however, that M. Rutot now recognises that the basal beds of the low Belgian terraces are contemporaneous with the deep beds of the 50-foot terrace of the Somme valley, and these beds contain a Chellean industry. The Mauer jaw, therefore, occurs at the horizon of the Chellean culture; it is the jaw of a man who lived in the time of Chellean culture. This, too, is the opinion of our highest authority—Professor Marcelin Boule.

We are led to the same conclusion by another route. We have seen (p. 289) that the Cromerian beds were probably deposited by the ancient Rhine when that river flowed down the North Sea valley or plain, and had its delta near the Dogger Bank. The sands at Mauer and the Cromerian beds, although 400 miles apart, are apparently contemporary deposits of the same watershed; both represent basal deposits of the low or 50-foot terrace. There are corresponding deposits of the same watershed in the lower valley of the Thames. These deposits of

the 50-foot terrace of the Thames yield Chellean implements. Mr Reid Moir found an early Chellean floor under the forest beds of Cromer. Thus we reach the

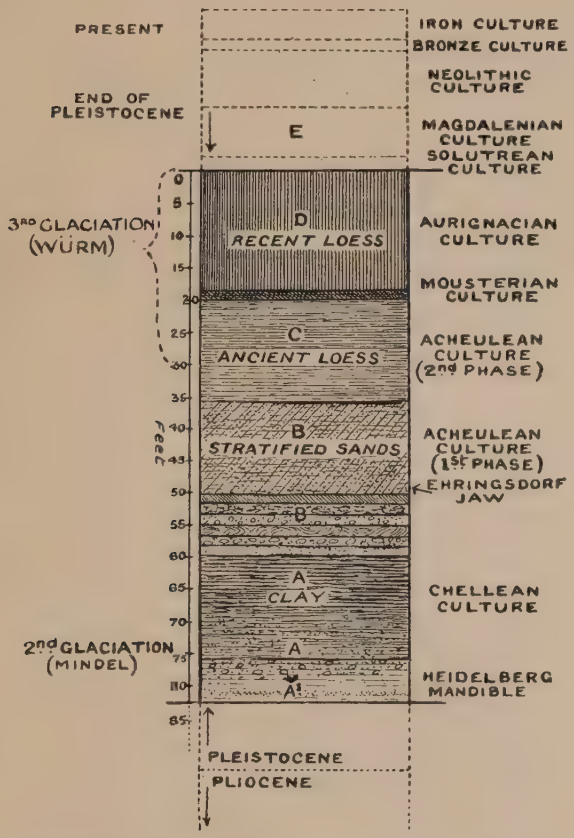

FIG. 116.—Diagrammatic section of the strata of the sand-pit at Mauer, with M. Rutot's more recent (1919) interpretation of cultural levels. The glacial periods are marked at levels which correspond with statements made in the text of this edition.

strange conclusion that although no Chellean industry has ever been found in Germany, yet the Heidelberg man, as known by the Heidelberg jaw, represents a man of Chellean times. It will be remembered that we are

proceeding under the belief that the Chellean culture was fully evolved one hundred and thirty thousand years ago.

An important inquiry has now to be made: How much can be inferred concerning *Homo heidelbergensis*, seeing that we know only his lower jaw and his lower teeth? In the first place, the characters of the teeth leave us in no doubt as to his race; he represents, beyond all question, a variety—a primitive variety—of Neanderthal man. It is strange that we have not found a single trace of this race since we parted from the deposits of the Mousterian period until now.[1] The pre-Mousterian strata have yielded us only remains of men of the modern type. Here, however, we come across Neanderthal man of a more primitive type than any yet found in Mousterian deposits. The teeth show those peculiar features which differentiate them from those of men of the modern type—the enlarged pulp cavities, the swollen crowns and bodies, the curtailed roots (see figs. 75 and 249). These are not primitive or simian characters, but the reverse; they are modifications confined, so far as we have yet discovered, to this peculiar variety or species of man—*Homo neanderthalensis*. In these same features, man of the modern type—*Homo sapiens*, as he is named—resembles the apes. Here, then, is an important fact—that early in the Pleistocene period that peculiar feature of the teeth which characterises the Neanderthal species of men was already evolved.

One other feature of the Heidelberg dentition impresses the anatomist. At such an early date as the beginning of the Pleistocene period he is prepared to find in the canine or eye teeth some resemblance to the pointed canine teeth of apes. This expectation is founded on the form of the canine teeth of modern man, and the peculiar manner of their eruption. In the Heidelberg dentition the canines are even less ape-like than in modern man—they have subsided into the ranks of the ordinary teeth. In this we find a second point which bears on the antiquity of man. In this early

[1] The Ehringsdorf jaw may prove to be Acheulean in date (fig. 116).

species of man the canine teeth have assumed the "human" form.

The Neanderthal nature of the Heidelberg mandible is rendered apparent by such a comparison as that made in fig. 117. The body of the Heidelberg jaw, that part of it which carries the teeth, is set beside the opposite half of a mandible from Spy. In the adjacent figure halves of an English and of a Tasmanian mandible are contrasted. The Spy mandible represents the Neanderthal type; the Tasmanian illustrates a primitive

FIG. 117.—The right half of the body and teeth of the Heidelberg mandible viewed from above, and contrasted with halves of the mandibles of Spy man, of a Tasmanian, and of a modern European.

modern type. It is unfortunate for our comparison that the molars of the Spy mandible are the smallest known in a Neanderthal specimen. Their total length, measured along the arch of the teeth, is 32·2 mm.; the three Heidelberg molars measure 36 mm. Amongst the Krapina molar teeth there are many of a larger size than those of the Heidelberg mandible. In the Tasmanian mandible the molars are particularly large for a modern dentition, totalling 36·4 mm., rather more than the Heidelberg molars. The front teeth—incisors, canines, premolars—of the Heidelberg mandible are of the same shape as those in the Spy mandible, only slightly larger. The Tasmanian teeth are quite different—more primitive.

The teeth of Neanderthal man are arranged in an arch

of characteristic form, the arch being flattened in front and the two sides of the arch widely separated (fig. 241). These characters are readily recognised in the Heidelberg mandible. In the primitive modern jaw the dental arch is elongated and more simian in form. As may be seen from fig. 117, the long diameter of the dental arch measured 62 mm. in the primitive Tasmanian, 60 mm. in the Heidelberg mandible, and 54 mm. in the Spy mandible. In width, however, the Neanderthal dental arch is much the greater. It measures 68 mm. in the

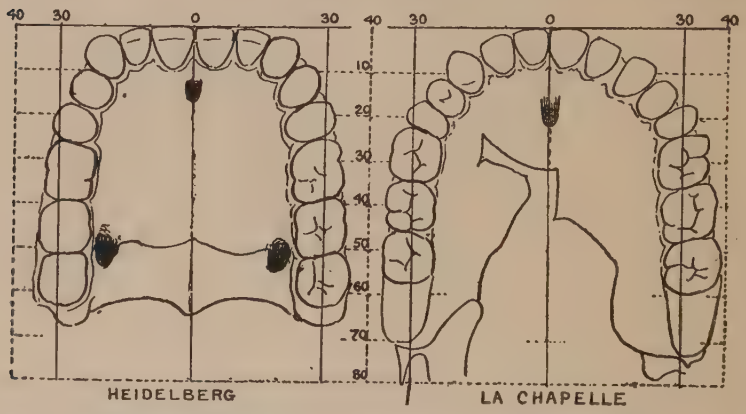

FIG. 118.—Reconstruction of the palate of the Heidelberg man, compared with Professor Boule's reconstruction of the La Chapelle palate.

Heidelberg specimen, 69 mm. in the Spy, and 61 mm. in the Tasmanian mandible. The peculiar adaptation of the Neanderthal teeth—their wide crowns, large bodies, short roots, and the wide and relatively short dental arch, all point to a rough vegetable diet necessitating a grinding rather than a cutting manner of mastication. From the arch of the lower teeth it is possible to reconstruct the size and arrangement of the upper teeth and palate of the Heidelberg individual. In fig. 118 this reconstruction has been carried out in order that a direct comparison may be made between the palate of the Heidelberg man and the Neanderthal variety discovered at La Chapelle-aux-Saints (see p. 173). The

palate in the latter case was broken and the teeth lost. Professor Boule was therefore obliged to reconstruct the palate in that case also. The palatal area in each is almost the same—39 cm.^{2} in the La Chapelle specimen, 39·7 cm.^{2} in the Heidelberg specimen, and 36·7 cm.^{2} in the Tasmanian. The width of the two palates shown in fig. 118 is almost the same, 72 mm.; and the length is nearly the same, 64 mm. in the La Chapelle and 63 mm. in the Heidelberg palate. From the palate we infer that the Heidelberg man cannot have stood

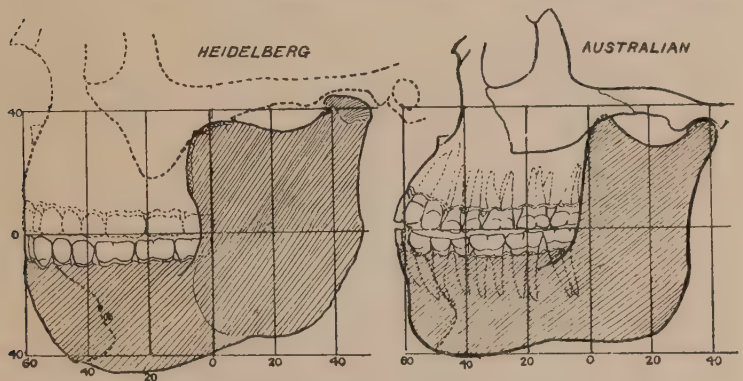

FIG. 119.—Profile of the Heidelberg mandible compared with the profile of the mandible of an Australian native.

much lower in the human scale than Neanderthal man of the Mousterian period.

If we confine our attention to the teeth, we have no hesitation in assigning the Heidelberg jaw to a primitive variety or race of Neanderthal man. From the very first, anatomists have been struck by the apparent discrepancy between the "humanity" of the teeth and the massive power—almost bestiality—of the jaw itself. The impression we obtain from a close inspection is one of its great strength. This is very noticeable when a comparison is made such as is shown in fig. 119. In that figure the Heidelberg mandible is shown in profile, and placed beside a corresponding view of the mandible of an Australian native. The comparison

brings out an extreme degree of divergence. This is particularly evident in the ascending branch or ramus to which the muscles of mastication are attached. The size or area of this branch may be taken as an index of the size and strength of the muscles of mastication. In height the ascending branch of the Australian mandible is practically the same as that of the Heidelberg specimen, but in width the latter measures 60 mm.—22 mm. more than the primitive Australian native. The area represented by the outer surface of the ramus of the ancient mandible is 34 cm.^{2}; the corresponding area in the Australian measures 22 cm.^{2}; an average modern European mandible, 18 cm.^{2}. These measurements give some idea of the surpassing strength which must have characterised the masticatory system of the Heidelberg man.

The chief difference, however, is seen in the region of the chin and symphysis. In the Australian, although there is no prominent chin, yet the anterior or labial surface of the mandible ascends almost at right angles to the lower border of the jaw. The alveolar border, in which the teeth are implanted, is not prolonged forwards markedly in advance of the lower border of the mandible. The reverse is the case in the Heidelberg jaw—the alveolar border is prolonged far forwards and the chin recedes almost as in an ape. On its posterior or lingual aspect the symphysis of the Heidelberg mandible shows the genial pit already described in connection with the chin region of Neanderthal man (see p. 208); but there is this difference, the pit is deeper, wider, and more ape-like than in any specimen belonging to the Mousterian period. As regards the markings of the chin—the markings connected with the attachment and mode of action of the muscles of the tongue—the Australian mandible shows all those features which characterise modern man. In the Heidelberg mandible, on the other hand, we see the same peculiarities as in Neanderthal man, but to an exaggerated and to a more primitive degree.

To show how the Heidelberg mandible compares with

that of an anthropoid ape, I have superimposed its outline, in fig. 120, on a drawing made from the mandible and face of a female orang—both on the same scale. In height and area of the ascending branch of the jaw there is not much difference between the ape and Heidelberg man, but in actual shape, particularly in the form of the coronoid process, the anthropoid and Heidelberg types depart widely. Although the Heidelberg muscles of

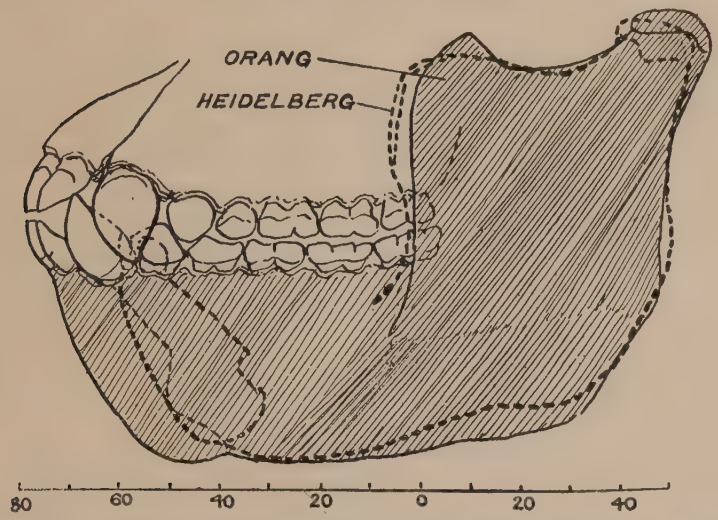

FIG. 120.—Outline of the Heidelberg mandible compared with a drawing of the lower jaw and face of a female orang. Both are drawn to the same scale.

mastication must have been of great strength, yet the markings for their implantation on the mandible are those seen in human jaws—but never on the mandibles of anthropoid apes. In the region of the symphysis there is also a striking difference. On the posterior aspect of the anthropoid symphysis is seen the wide pit or genial fossa, bounded at the lower border of the symphysis by the simian plate (see fig. 74, p. 208). There is no simian plate, nor any trace of it, in the Heidelberg mandible.

In fig. 121 a final comparison is made to show the degree of resemblance between the mandibles from Spy

and Heidelberg. The differences are those of degree, not of kind. It is true that the ascending branch of the Heidelberg specimen is much the larger. As regards size and shape, the body of the mandible—the part on which the teeth are implanted—is very much alike in both cases. In the region of the symphysis the Heidelberg mandible shows more primitive characters; its upper or alveolar border is more projecting; there is no

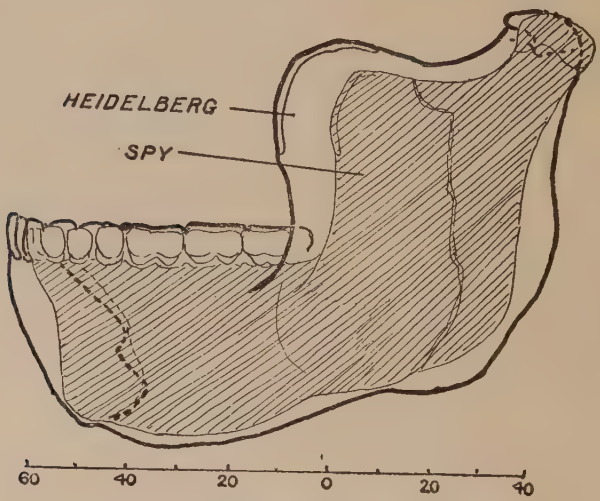

FIG. 121.—Outline of the Heidelberg mandible compared with the Spy mandible.

indication of a chin. In the Spy specimen the rudiment of a chin is apparent. Again, on the posterior aspect of the symphysis the genial pit—a simian structure—is almost filled up in the Spy specimen. This pit is open in the Heidelberg mandible almost to the extent seen in young gorillas (see also p. 208).

There is another feature worthy of note, illustrated by the various drawings represented in fig. 117. In these drawings the Heidelberg, the Spy, a Tasmanian mandible, and a European mandible are represented from exactly the same point of view—at right angles to the chewing plane of the teeth. Such a view gives a clear idea of what

is meant by the opening out of the floor of the mouth. The lower border of the mandible bounds this floor. Even in the primitive Tasmanian very little of the symphysis or of the lower border of the mandible is seen within the arcade of the teeth (fig. 117). In the Heidelberg mandible, and to some degree in that from Spy, the lower part of the symphysis encroaches, as in the ape (see fig. 239, p. 653), on the floor of the mouth. Yet, in spite of this ape-like feature, we must grant, I think, the possibility of speech to the Heidelberg man. We cannot withhold such a faculty from Neanderthal man, such as the one found at La Chapelle-aux-Saints, who had a brain above that possessed by the average modern man. In the Heidelberg mandible we find the usual Neanderthal features of the chin, only they are more primitive—more simian in their development. If we allow full speech to the Mousterian man, we must, at least, assume the beginnings of such a faculty for Heidelberg man.

How does the Ehringsdorf mandible compare with the one from the Mauer sands ? The Ehringsdorf specimen, as we have seen (p. 192), came from a valley deposit near Weimar—160 miles to the north-east of Heidelberg, this deposit being also a member of the low terrace series. In fig. 116 its horizon is indicated as at the level of Acheulean culture—thus falling in point of time between the Mauer and Spy specimens. Although the Ehringsdorf mandible may be unhesitatingly assigned to a person of the Neanderthal type, yet this person did not represent a phase in the evolution of the Heidelberg into the Spy stage. In the Ehringsdorf mandible the dental arcade is slightly narrower and also slightly longer than in the Heidelberg jaw, and in this respect is the more simian ; it also differs from the Heidelberg specimen in being shallower in the region of the symphysis or chin, and also at the sides—in the molar and premolar regions. We may safely infer that the Ehringsdorf people represented an early and distinct racial variety of the Neanderthal type.

When we compare the Heidelberg mandible with one

of the later Mousterian men of France or Belgium we see the same kind of differences as are to be noted when a comparison is made between the mandibles of an Australian aborigine and of a modern European. The one shows a robust development of tooth and bone ; the other a reduction of tooth size and particularly of bone development. No doubt this change is associated with a change of dietary—perhaps with the discovery of fire and the art of cooking; yet, as I have sought to show elsewhere,[1] these changes are probably not due directly to a lessened use of the jaws. There seems to be some mechanism at work which slowly adjusts the relative development of brain and jaws.

A suggestion made by Professor Elliot Smith [2] has a direct bearing on the problem we are now considering. He is of opinion that the human brain must have reached almost its full development, and that speech was probably in process of evolution, before the mandible, tongue, and other parts which subserve the purposes of speech had become finally and fully adapted to their new functions. This is very likely to have been the case. At least, we find in men of the Mousterian period a dentition very similar to that seen in the Heidelberg individual, and with mandibles, perhaps not so robust or so primitive, but yet in essential characters like the Heidelberg. In Neanderthal man these characters of teeth and jaw were associated with a large brain—one which was capable of subserving the faculty of speech. We have every reason to suppose, then, that the Heidelberg man, with similar characters of jaw and teeth, had also reached a high development of brain. If Professor Elliot Smith's suggestion holds true, namely, that in the process of human evolution the brain leads the way, it is possible that the brain of the Heidelberg man may well have been as large as that of Neanderthal man.

[1] Huxley Lecture, "The Adaptational Machinery concerned in the Evolution of Man's Body," *Nature* (Supplement), 18th August 1923.

[2] See his address as President of the Anthropological Section of the British Association at Dundee, 1912.

In this chapter we have come across a series of facts which throw a clear light on the early inhabitants of that part of Europe which lies between Central Germany and Southern France. From the genial climate of early Chellean times, represented by the Mauer sands and Cromer beds, to the Arctic climate of late Mousterian times, when men had taken to a cave life, we find this part of Europe in possession of a Neanderthal stock. We have met with evidence which shows that this stock changed and evolved in Central and Western Europe. We have not so far found a bone of Neanderthal man in England—all the remains yet found, including the remains of Galley Hill man, have been those of the modern type of man.

This chapter brings us again face to face with an important problem. The geological evidence has compelled us to assign the Heidelberg man to almost the same cultural horizon as Galley Hill man ; both belong to the period of Chellean culture. Is it possible that a type so primitive as that of Heidelberg could have been alive in Southern Germany when a type so modern, so like ourselves, as that of Galley Hill, was ranging the Kentish Downs ? In our next chapter further light will be thrown on this matter.

CHAPTER XVII

IS *HOMO SAPIENS* AN ANCIENT TYPE ?

No revelation of prehistoric man could be more convincing than the discovery of the Heidelberg mandible. We have no shadow of doubt as to its authenticity or significance. We accept as a definite and indisputable fact that there lived a primitive form of Neanderthal man in South Germany in early Pleistocene times, bestial in structure beyond all kinds of men now living. The discovery we are now to relate is the old and well-known story of Castenedolo—the antithesis of the one narrated in the last chapter. At Castenedolo, in North Italy, we obtain all the details relating to the finding of remains of a people of the modern type embedded in strata much older than the sands at Mauer. As the student of prehistoric man reads and studies the records of the "Castenedolo" find, a feeling of incredulity rises within him. He cannot reject the discovery as false without doing an injury to his sense of truth, and he cannot accept it as a fact without shattering his accepted beliefs. It is clear we cannot pass Castenedolo by in silence: all the problems relating to the origin and antiquity of modern man focus themselves round it.

If the map of North Italy be examined, it will be seen that the railway between Milan and Verona keeps close to the southern flanks of the Alps, and passes the town of Brescia on the way. In 1860, Professor Ragazzoni—an expert geologist—was a teacher in the Technical Institute of Brescia. He was particularly interested in the fossil shells of the Pliocene formations which abound in North

Italy. One of the favourite sites for collecting such specimens was a low hill, only about 100 feet high, which rises from the plain at Castenedolo, about six miles to the south-east of Brescia. Fig. 122 reproduces a section which he drew to explain the geological formation of the hill. The exact number and sequence of the strata do not concern us now. We note that the second stratum is a deposit of boulder clay indicating one—probably the greatest—of the Pleistocene glaciations. The strata which have a direct interest for us are those numbered 8 and 9: No. 8 a deposit of greenish-blue clay containing

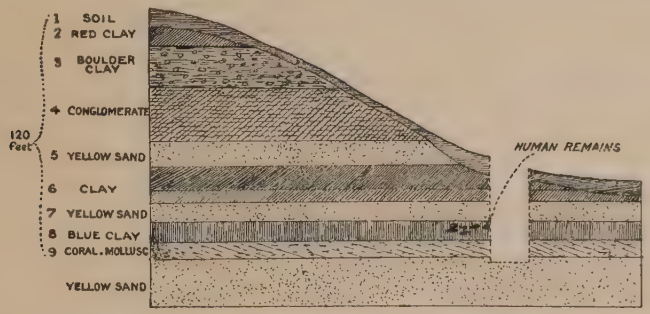

FIG. 122.—Section of the hill (Colle de Vento) at Castenedolo, near Brescia (Ragazzoni).

shells—about 5 feet in thickness; No. 9 a deposit rich in coral débris and in fossil shells. About the age of the coral stratum there is no dispute; it was deposited when a Pliocene sea lapped against the southern flanks of the Alps. Were it to occur in England it would lie under the Red Crag of Suffolk, for it belongs to the older Pliocene formation. The overlying blue clay, deposited from still, muddy waters, is not much later in date than the coralline stratum.

Late in the summer of 1860, Professor Ragazzoni visited Castenedolo, and had descended the pit, cut at the foot of the hill (see fig. 122), and was searching the coralline stratum for Pliocene shells. As he searched he uncovered, on the face of the pit between the blue clay above and the coral stratum below, the fragmentary vault

of a human skull. It was coated and impregnated by the clay and shells of the strata between which it lay. Ragazzoni examined the overlying strata—one of yellow sand, another of grey sand—above the clay, and could see no trace of a disturbance at their lines of junction. He searched further and found a few other cranial fragments near the same site. He took his "finds" home, and showed them to some of his colleagues at the Technical Institute. His discovery was received with incredulity.

Until 1880—twenty years after the first discovery—nothing further was found in the pit. In that year, however, a friend of Ragazzoni's—who believed in the first discovery—commenced to excavate in the pit about twenty paces from the site at which the human remains were found. In two months he exposed, at the same horizon, between strata 8 and 9, numerous and scattered fragments of the skeletons of two children. The fragments were left *in situ* until seen and examined by Professor Ragazzoni. Again the overlying strata were found intact. Then a further discovery was made—the skeleton of a woman in the contracted posture, compressed and disturbed by earth-pressure. The woman's skeleton lay within the clay stratum—a little over 3½ feet from the surface of the bank. The other human remains lay at a depth of 6½ feet from the top of the bank—the surface level of the soil.

In 1883, Professor Sergi,[1] then a rising anthropologist, visited Ragazzoni at Brescia and saw the human remains found in the Pliocene strata at Castenedolo—still covered by fragments of the original matrix in which they had been embedded. He found that the remains were those of people of the modern type. Two children, a man, and a woman were represented by the fragments, but only

[1] Professor Sergi has kindly supplied me with copies of the papers he has written on the Castenedolo remains. See *Archivio per l'Antrop. e l'Etnol.*, 1884, vol. xiv., No. 3. *Ibid.*, 1886, vol. xvi., No. 3. *Rivista de Antropologia*, 1912, vol. xvii., fas. iii. See especially his later work, *Le Origine Umane: Ricerche paleontologiche*, Torino, 1913.

the skull of the woman was complete enough for a reconstruction. Professor Sergi was impressed by both the discovery and the discoverer. He went with Ragazzoni to the pit, made a fresh section of the strata, and was convinced that all was as Ragazzoni claimed, namely, that he had discovered human remains in undisturbed beds of a Pliocene age. The race was of the modern human type. Some time before he died, Professor Ragazzoni placed the human remains discovered at Castenedolo in

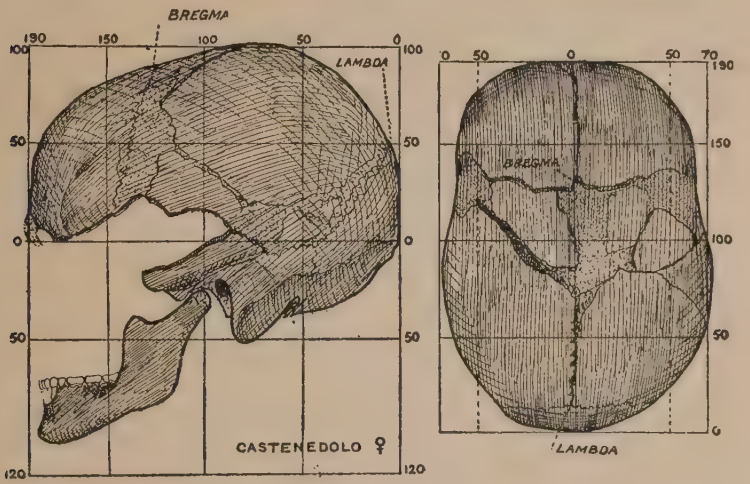

FIG. 123.—Woman's skull found at Castenedolo, viewed from the side and from above. (After Sergi.)

Professor Sergi's custody, and they are now preserved in his department in the University of Rome.

In fig. 123, I reproduce two drawings of the woman's skull copied from Professor Sergi's excellent illustrations, but fitted within the conventional standard lines used in former illustrations. The length is 189 mm.; the width, 135 mm., being 71·4 per cent. of the length. The dimensions are above those of the average modern European woman. The vault of the skull rises 115 mm. above the ear-holes, the pitch of the roof being thus an ordinary one. The brain capacity must have been about 1340 c.c.—the average for modern European women.

The bones of the vault are not thick. The forehead is wide (103 mm.) and almost vertical. There is a complete absence of supra-orbital ridges. The lower jaw is small, the chin pointed, the angle between the ascending ramus and body very obtuse (130°), as in women with long, narrow, oval faces. It is a long, narrow skull, with not a single character we can identify as primitive. Indeed, if tested side by side with the skulls of modern women belonging to primitive races, we should select the Castenedolo skull as representing the more highly evolved example of the modern type. Yet there is also this striking fact to be kept in mind: it is an exact counterpart of the skull found at a depth of 50 feet in a Pleistocene deposit at Olmo, which lies 150 miles to the south of Brescia. The Olmo skull is that of a male, the Castenedolo that of a female, but both are of the same race. The discovery at Castenedolo convinced Professor Sergi that men of the modern type were already evolved in the Pliocene period. His sincere and intrepid advocacy compelled the attention of his contemporaries. The leading anthropologists of Paris gave it a mixed reception. Quatrefages believed in the Castenedolo discovery, and he and Hamy gave it a place in that Valhalla of ancient skulls—the "Crania Ethnica." Gabriel de Mortillet and Topinard refused to believe in it. Sergi, however, has never faltered in his belief. Even, as he himself relates, when Ragazzoni summoned him and Professor Issel to examine another Castenedolo skeleton exposed *in situ* in 1888, and when both were convinced that the skeleton represented a comparatively late interment, his faith in Ragazzoni's former discoveries did not waver. To him those early discoveries were guarantees that men of the modern type were evolved as long ago as the beginning of the Pliocene period.

Castenedolo is a test case: it raises all the issues relating to the antiquity of modern man. Are we quite sure Sergi is mistaken? Let us review briefly the principal facts on which our knowledge of the antiquity of man rests —man as we know him to-day—separating "certainties"

from the "probabilities" and the "possibilities." Beyond any doubt we have traced men of the modern type—men belonging to races as highly evolved in body and brain as any race now living—to the beginning of the Aurignacian period. The men of Combe Capelle and of the Grimaldi caves were as highly evolved as any modern people, and yet they may have seen—probably did see—the Neanderthal men, and disliked the forbidding prominence of their simian brow-ridges.

Towards the close of the period of Mousterian culture men of the modern European type appear suddenly in lands to the north of the Mediterranean—strong in tooth, robust in jaw, big brained and fully developed in type. Where did they come from? In which land were they evolved? We have only circumstantial evidence to guide us, but this evidence points to the Pleistocene temperate lands, stretching from Afghanistan in the East to Morocco in the West—lands which are now reduced to sandy wastes, as the homeland of the white man. It was to help us in solving our present inquiry that we made a survey of Mesopotamia and Egypt in the second chapter of this book. Our survey showed us, that although the oldest skeletons found in the Nile valley are probably not more than six thousand years old, yet there was evidence sufficient to support the thesis that the adjacent deserts had been fertile lands and inhabited by men during the Palæolithic period, and that the men who lived on them were of a European type. It is perfectly legitimate for us to presume that the men who appeared in Europe at the close of the Mousterian period, and who ultimately supplanted the Neanderthal stock, came from the Africo-Asiatic belt, and that it was somewhere in this wide belt that the white stock was evolved.

Was the arrival of the modern type of man, at the close of the Mousterian period, his first appearance in Europe? If we accept the discoveries at Galley Hill, at Clichy, and at Olmo as authentic, then it was not; there was a pre-Mousterian as well as a post-Mousterian invasion. If we accept a pre-Mousterian invasion then we have to presume

that men of our own type were fully evolved and invaded Europe when Germany was occupied by beings so primitive as the Heidelberg and Ehringsdorf people. We have to presume further that their invasion failed, and that they were extinguished by men of the Neanderthal stock, for only men of this stock have been found in European graves of the Mousterian period. When the matter is argued thus, it becomes increasingly difficult to accept the geological evidence relating to Galley Hill, Clichy, and Olmo skeletons.

There is, however, an alternative interpretation. While the Chellean industry abounds in the early Pleistocene deposits of the valleys of the Somme and Thames it is unknown in the contemporary deposits of Germany. Is it possible, then, that the Chellean industry was evolved in the valleys of the Somme and Thames by men of the Galley Hill type (a modern type of European) at a time when more northern Europe was inhabited by benighted people of the Heidelberg type ? We must, in this case, also believe that the Neanderthal people, the progeny of the Heidelberg type, ousted the higher form of man from Europe before the dawn of Mousterian times. Only fresh facts, elicited by further discoveries, can resolve these problems.

Beyond Heidelberg our record ceases in Europe with two exceptions—the discovery at Piltdown and the one discussed in this chapter, Castenedolo. The latter may be dismissed ; the unfossilised condition of the remains and other circumstances make us certain we are here dealing with intruded burials. Yet one cannot say that the existence of man of the modern type in the Pliocene period is outside the range of possibilities. Sergi, in defending this thesis, cites the geological histories of the wolf, the bear, and of that interesting anthropoid ape—the gibbon ; all of these had reached their present stages of evolution in the Pliocene, and if this were possible for them why deny the same possibility to *Homo sapiens* ? Indeed there is a line of evidence which compels us to postulate a distant date for his evolution. We find him

to-day differentiated into forms so distinctive as the negro, the Eskimo, the Australian aborigine, and the European; the differentiation of these types implies a long period of evolution—one which must have had its beginning long before the end of the Pliocene period. We cannot tell how ancient the European type of man is until we discover his fossilised ancestral stages—and discover them amidst geological or archæological surroundings which permit us to assign them to definite dates in the geological or archæological calendar. Up to the present day not one of these stages has been found, but who can say what a decade may bring forth—particularly if lands to the south of the Caspian and of the Mediterranean be explored? In the meantime much can be learned concerning the antiquity of man from explorations made outside the continent of Europe. In our next chapter we set out on a world-wide search.

CHAPTER XVIII

MALTA AND THE LAND-BRIDGE TO AFRICA

In this chapter we are again to turn our faces towards Africa to search that great continent for ancient types of man. Our visit to Castenedolo, mentioned in the previous chapter, took us to Italy, and it is from this country that we are to set out on our survey. In ancient days its southern or "booted" end formed the bridge-head for the neck of land which crossed the Mediterranean to Tunis, thus making possible a free migration of man and beast between Africa and Europe (fig. 124). If there is aught of truth in the contentions put forward in the previous chapter, that the original homeland of the European type lies beyond the Mediterranean, then this ancient bridge between Italy and Tunis must be given our serious consideration. All of it now lies 1200 feet and more under the blue waters of the Mediterranean, all save two fragments represented by Sicily and the small island of Malta. Recent discoveries in Malta, we shall find, have revealed something of ancient Pleistocene times and of the men who lived on the land-bridge.

In previous chapters mention has often been made of "raised beaches" and "river terraces" which mark times when the land stood lower (or the sea rose higher) than it does at the present day. They represent times of land depression, but until now we have had no opportunity of estimating the opposite kind of movement—one in which the land rises or the sea recedes—or it may be that both factors are concerned. In discussing the ancient land-bridge between Italy and Tunis—

which for brevity's sake may be named the "Sicilian bridge"—we shall speak as if the sea-level were stationary, and as if the movement concerned only the land. To reconstitute the Sicilian bridge—to bring the sea floor just above the level of the waves—requires an upward movement of 1200 feet; it is probable that the actual movement involved an elevation of the sea floor to twice the amount just stated. Yet there is

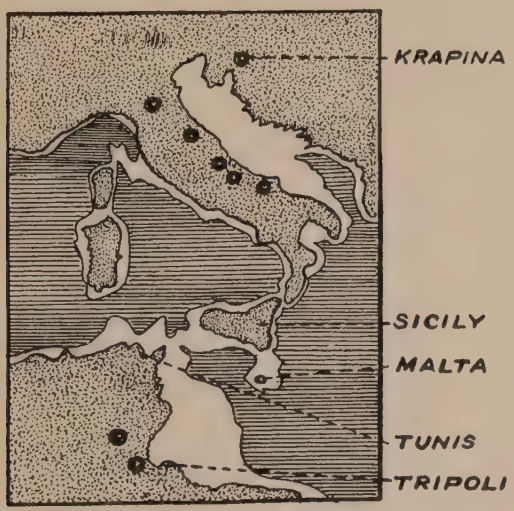

FIG. 124.—Map of the Pleistocene land-bridge between Italy and Tunis; some of the sites of Mousterian culture, in Tunis and Italy, are indicated.

no doubt that this bridge was in existence in the latter part of the Pleistocene period. From a study of the fossil remains of animals found in Sicily and Malta, geologists infer that the bridge was raised and again submerged at least twice—once towards the close of the Pliocene period and again in late Pleistocene times. From evidence collected in Malta, Mr George Sinclair [1] infers that subsidence of the island has been proceeding at the rate of a foot per century since Phœnician times. If subsidence of the Sicilian bridge has taken place at

[1] *Journ. Roy. Anthrop. Instit.*, 1924, vol. lv.

this average rate, then the land connection between Italy and Tunis was broken 12,000 years ago. We shall see that there is evidence of this bridge having been submerged at least three times during the Pleistocene period. If only we could again raise the Sicilian bridge and bring into the light of day its ancient beaches and shore-lines —beaches which now lie some 2000 feet below the surface of the Mediterranean—we could soon settle both its dates and heights. For in the submerged beaches and in the submarine fields are hidden away traces of the men, animals, and plants which knew the land-bridge in its heyday.

Sicily and Malta are isolated areas of the high uplands of the old land-bridge. Evidence of another kind throws light on the dates at which the land-bridge was in existence. In fig. 124 there is shown along the map of Italy a series of sites where Mousterian culture has been discovered. There are similar stations in Tunis, beyond the southern end of the bridge, and there are sites on the bridge itself—in Sicily. The Mousterian culture evidently spread along the bridge, but whether from Europe to Africa, or in the reverse direction, we cannot tell. In North Africa, just as in Europe, we find the flint implements of the Acheulean and Chellean cultures,[1] showing that Europe was directly or indirectly in touch with Africa during the earlier phases of Palæolithic culture.

The land-bridge has had not only its times of elevation —movements which may have raised its upland parts 2000 feet or more above the level of the subdivided Mediterranean—but it had also its periods of subsidence, periods in which it was submerged to a greater depth than is now the case. All round the Mediterranean General de Lamothe has traced four ancient beaches, formed by the Mediterranean during periods of subsidence. One of these—the latest in date—stands about 10 to 20 metres above the sea and corresponds to the 50-foot terrace of the Thames valley. The next in date

[1] Maurice Reygasse, *L'Anthropologie*, 1916, vol. xxvii. p. 35.

occurs about the 30-metre level and corresponds to our 100-foot terrace. Two other beaches occur at higher levels, namely, at 60 metres and at 100 metres. Professor Charles Depéret [1] proposes to divide the Pleistocene period into four ages, each age corresponding to the formation of a terrace. The 100-metre terrace does not concern us here; on our English scale it falls within the Pliocene period. But the other three have an important bearing for us now because they fall within our Pleistocene scale. The 60-metre terrace was deposited when the Chellean culture was still in its infancy. The 30-metre terrace marks the period when the Chellean culture was at its height; the 10–20-metre terrace was formed before the end of the period of Mousterian culture. Now, as these terraces can be traced on to surviving fragments of the land-bridge, we may be certain that at the three cultural periods just named it had been submerged to a greater extent than it is to-day. We cannot tell the exact times at which the land-bridge was elevated, although the periods at which it became submerged and disappeared can be fixed with some degree of accuracy. This brief history of the ancient Sicilian bridge will give the reader some conception of the magnitude of the land (or sea) movements which have taken place, and the length of the time which must have elapsed since early man appeared on the shore-lands of the Mediterranean.

So far we have been surveying the land-bridge from the Italian side. We are now to plant our feet on it—or rather on a small unsubmerged area—the island of Malta, where a cave known as Ghar Dalam has recently yielded strange information concerning the ways of ancient men—men of the land-bridge. Away in the south-east corner of Malta, some five miles from Valetta, there is a large bay, the Marsa Scirocco, which Phœnician sailors used as a harbour. At the head of this bay a rocky ravine—the Wied Dalam—cuts into the limestone plateau of the island, in a north-westerly direction.

[1] See references given on p. 312.

Ascending this ravine for about 700 paces the traveller finds the mouth of the cave on his right, opening from the side of the ravine, the sill of the mouth being 50 feet (15·2 metres) above sea-level. When the cave is entered it is found to open out in front of the traveller as a long, irregular, rambling tunnel, penetrating the limestone plateau for a distance of some 700 feet. The first, or main part, of the cave, 270 feet long, varies in width

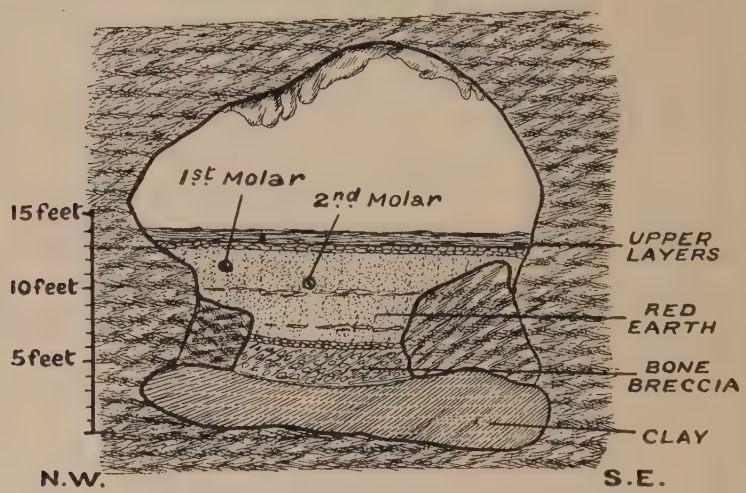

FIG. 125.—Section across Ghar Dalam, showing the strata which make up its floor. (After George Sinclair.)

from 20 to 60 feet, while overhead the roof, studded here and there with stalactites, is from 10 to 18 feet high.[1] Underfoot are the strata of the cave floor, varying from 15 to 18 feet in depth. It is important to note that the floor of the cave is nearly at the same level throughout, being 27 feet (7·1 metres) above the waters of the adjacent bay of the Mediterranean. In fig. 125 is shown a section across Ghar Dalam, with a representation of the various strata which make up its floor. Deepest of all, lying on

[1] G. Despott, "Excavations at Ghar Dalam," *Journ. Roy. Anthrop. Instit.*, 1918, vol. xlviii. p. 215; *ibid.*, 1923, vol. liii. p. 18. Sir Arthur Keith and George Sinclair, *Journ. Roy. Anthrop. Instit.*, 1924, vol. lv.

a rocky bottom, is a layer of yellowish clay, some 3 feet thick, a deposit laid down in still water but containing no fossils. Then comes a remarkable stratum, also about 3 feet in thickness ; large nodules and smoothed fragments of deeply mineralised bone and tooth make up three-fourths of its composition ; it is a bone breccia. In this stratum are represented parts of thousands of animals, the predominant species being a hippopotamus (*H. pentlandi*), but there are also representations of three species of elephant (*E. melitensis*, *E. mnaidrensis*, *E. falconeri*) ; there are traces of a species of deer akin to red deer. None of these animals are cave-dwellers by nature, so presently we shall have to explain how thousands of great pachyderms and other animals came to be entombed in the floor of this cave. This may not be an easy question to answer. On the other hand it is not difficult to determine how these fossil bones have become rolled out into pebble-like pieces. For we can still observe that the sides of the cave have been polished and undercut by wave action. At one time the floor of the cave must have been level with the beach and open to the sea. The bone stratum is clearly part of an old sea-beach —part of the lower Mediterranean terrace formed towards the end of the period of Mousterian culture. The skeletons, which have been ground to a bone breccia by the action of waves, must have accumulated on the floor of the cave before the date of submergence. We can speculate with some assurance as to the date when these huge accumulations of bones were formed in the cave. It must have been after the subsidence of Chellean times, when the 30-metre beach was formed and before the subsidence of Mousterian times, which gave rise to the lowest or 20-metre terrace. We infer, therefore, that between these two phases of subsidence Ghar Dalam became a charnel-house for hippopotamus and elephant. This interval corresponds to late Acheulean and early Mousterian cultures. At this stage of cultural evolution the land-bridge was in existence. There was also a post-Mousterian period of elevation.

Then above the bone stratum in the floor of the cave comes a deposit of red earth, formed by dust and fragments which have fallen from the sides and roof of the cave. This stratum, which is about 7 feet in thickness, has never been submerged. The red cave earth corresponds in date to the deposits of the Grimaldi caves in which were found the buried remains of men of the Aurignacian period (p. 96). The cave deposits at Grimaldi were formed upon the lowest of the old sea-beaches; so was the cave earth in Ghar Dalam. Above the red cave earth comes a superficial stratum which has been trod down by the feet of men of the Neolithic period.

Late in the summer of 1917, when Europe was aflame with war, Mr G. Despott, Curator of the Natural History Museum of Malta, was busy in Ghar Dalam, carrying out excavations on behalf of the British Association. He was sinking a trench across the floor of the cave, 110 feet from its mouth, and had dug some depth into the red cave earth. He found then, as he and other excavators had observed before, that Neolithic man had dug deeply into the cave earth, for burial and for other purposes. Thus fragments of Neolithic pottery, teeth, and fragments of human bones occurred occasionally as deep as the fourth foot of the red cave earth. At the same level he found the skull of the extinct Malta elephant with its neck vertebræ still adjoining it as in life, and the bones of a limb of an extinct hippopotamus (*H. pentlandi*) lying in their natural order. We cannot believe that the Neolithic people who first landed on Malta placed these fossil bones in the cave earth or saw such animals alive. It is these fossil bones and not the Neolithic pottery which fix the date of the cave earth.

As he sank his trench, Mr Despott found a molar tooth in the third-foot level of the red cave earth and again another in the fourth-foot (counting from the upper level of this stratum). These two molars differed from all the other teeth he found in being deeply mineralised and of a peculiar form; they are represented in fig. 126. One is the second upper molar of the right side; it is fully formed

but had been in use for only a short time, the cusps of the crown being but slightly worn. The other tooth is the last or third upper molar of the same side. It was in course of eruption, its root being incompletely formed. Both teeth are from the same individual, a young man of about twenty years of age, if the wisdom teeth of Neanderthal man cut at the age which is normal for modern man. We know of no race in which these taurodont

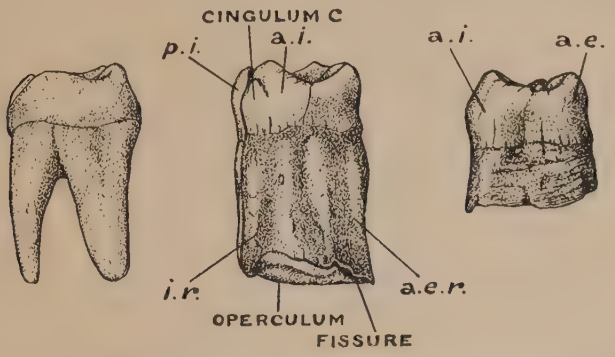

FIG. 126.—Two molar teeth of Neanderthal man found by Mr G. Despott in the stratum of red cave earth of Ghar Dalam. On the left, a corresponding view of a second upper molar of Neolithic man is also represented.

a.e., Anterior external cusp.
a.i., Anterior internal cusp.
p.i., Posterior internal cusp.
a.e.r., Anterior external root.
Cingulum c., Cusp of the cingulum.

teeth occur except the Neanderthal species.[1] Mr Sinclair was able to obtain from a cave in Malta over two thousand teeth of Neolithic Maltese, but not one showed a trace of taurodontism. For forty years past I have had opportunities of examining teeth of all races of men; I have never come across these peculiar teeth except in Neanderthal man. The discovery of these two teeth gives a complete assurance that Neanderthal man was still alive

[1] The only exception that I know of is recorded by Dr H. P. Pickerill of Otago, New Zealand, who came across an instance in the course of his practice (see *Proc. Roy. Soc. Med.* (Odont. Section), 1908–9, vol. ii. p. 150).

in Malta—on the land-bridge—when the red cave earth was being deposited, which, as already mentioned, I regard as a deposit contemporaneous with the Aurignacian strata of the Grimaldi caves. Although the Mousterian culture has been found in Sicily, not a trace of it has been found in treeless Malta, nor of any Palæolithic culture whatsoever, neither Chellean, Acheulean, Mousterian, nor Aurignacian. All we have found of Palæolithic man are these two molar teeth.

When the discoveries at Ghar Dalam were first brought to my notice, my interest was centred in the red cave earth and its fossil remains. It was only later that I sought to explain the presence of such vast accumulations of fossil remains in the bone breccia, representing thousands of hippopotami, as well as herds of strange elephants. It was not until I read Mr Sinclair's account of the reconstituted land-bridge and found that the bay of the Mediterranean—Marsa Scirocco—adjacent to the cave, had been a fresh-water lake in the uplands of the ancient land-bridge, that I realised the significance of the bone breccia in the floor of Ghar Dalam. Such an upland lake, as African sportsmen know, must have attracted herds of big game. A rocky ravine led from the shores of the lake to the mouth of the cave. The memory of the stratum of horse bones at Solutré (p. 88) came back to me; so, too, did the accumulation of mammoth bones at Predmost — the spoil-heaps of Aurignacian hunters.[1] The hippopotamus, the elephant, the red deer, do not flock to caves to die; they only enter under compulsion. Here, too, were all the conditions required for the successful corralling of big game—the lake, the rocky ravine leading from it to the cave, the open mouth of the cave on the side of the ravine, into which ancient hunters could have headed herds which had been stampeded up the ravine from the lake. I can see no alternative explanation to account for such vast accumulations of fossil remains in Ghar Dalam. The bone breccia represents the proceeds of hundreds of successful hunts,

[1] See p. 105.

and the hunters were men who lived on the land-bridge between Africa and Europe, when hunters shaped their stone weapons in the Acheulean style.

So much for the ancient land-bridge; we must now proceed to the deserts and jungles of Africa. Approaching Africa by the old land-bridge we reach Cape Bon in Tunis, and from this point we shall set out to make a cursory survey of the more important traces of ancient man in that part of the great continent which lies north of the Equator. Before us are the great sandy wastes of the Sahara, covering an area almost as extensive as Europe itself. Between the Sahara and the Mediterranean are Tunis and Algiers, where French archæologists have discovered the same stone cultures as occur in ancient Europe[1] —Chellean, Acheulean, and Mousterian. The Acheulean culture is separated from the Chellean less sharply than in Europe, and shows tendencies to specialise in unexpected directions. The Mousterian culture, too, has elaborations not found north of the Mediterranean. The Aurignacian culture of North Africa has so many distinctive features that it is spoken of as Getulian or Capsian. We cannot tell as yet whether any or all of these ancient cultures were invented in Africa and then spread to Europe or if matters fell out in an opposite way. It is sufficient for us to note that in ancient times, as to-day, the frontiers of Europe extended to what is now desert. The Sahara is a great racial frontier; north of it we find men of the European type, south of it men of the true African or negro type.

To pass from Cape Bon in Tunis to Thebes in Upper Egypt we have to cross 1500 miles of land which, although now desert, was fertile in ancient times (see p. 38). The western bank of the Nile at Thebes, as we have seen, rises into three terraces which are respectively 360 feet, 280 feet, and 170 feet above the river; they appear to correspond in date of formation to the three lower terraces of the Mediterranean. From these terraces

[1] Maurice Reygasse, *L'Anthropologie*, 1916, vol. xxvii. p. 35. P. Poel, *ibid.*, 1917, vol. xxviii. p. 351.

and from the plateau above, Dr C. G. Seligman [1] gathered representations of all the ancient stone cultures just enumerated in Tunis and Algiers. Then, resuming our journey and passing over another 1500 miles of country, chiefly of a desert kind, we reach Somaliland, where Mr H. W. Seton-Karr [2] found the same ancient stone (quartzite) cultures. To-day Somaliland is inhabited by a negroid people, black-skinned, fuzzy-haired, but with facial features of the European type.

From Somaliland it is not a far cry to Uganda, situated on the north side of the Equator. The British Protectorate stands on the north shores of the great Victoria Lake, right in the midst of the tropical belt and 3000 miles from our starting-point at Cape Bon. Even here we are not beyond the range of the ancient stone cultures of Europe. The discovery of these cultures in Uganda we owe to Mr E. J. Wayland, Director of its Geological Survey. He observed that Lake Victoria, like the Mediterranean, had its old shore-lines and adjoining gravel terraces.[3] In these terraces and on them, Mr Wayland collected quartzite stone implements which when classified in a scale of ascending antiquity, read thus: (1) Transitional or neo-Palæolithic; (2) Aurignacian; (3) Mousterian; (4) mixed Chellean-Acheulean; (5) pre-Chellean. Between Uganda and East Anglia 4000 miles of land and sea intervene, and yet in Mr Reid Moir's [4] opinion—and no one is better able to judge than he—the pre-Chellean implements gathered from the gravel terraces of Lake Victoria show the same general design and workmanship as the shaped flints he discovered in the East Anglian terraces of the North Sea. We are apt to think of Africa as the dark continent, as a land which

[1] *Journ. Roy. Anthrop. Instit.*, 1921, vol. li. p. 115.

[2] See J. de Morgan, *L'Anthropologie*, 1921, vol. xxxi. p. 37.

[3] E. J. Wayland, "The Stone Age in Uganda," *Proc. Prehist. Soc. East Anglia*, 1923, vol. iv. p. 96. Reginald A. Smith and E. J. Wayland, *Publications of the Geological Survey, Uganda Protectorate*, January, 1923.

[4] J. Reid Moir, "Large Quartzite Implements of Rostro-Carinate and Early Palæolithic Types in Uganda," *Nature*, 1921, vol. cvii. p. 649.

became open to European influences for the first time in our day, but here we have evidence of penetration of culture at the very dawn of man's Stone age. I do not suppose that at any stage of man's evolution the spread of culture depended on its carriage by marauding bands or migrating hordes. As far back as our archæological records can carry us, humanity seems to have formed a sea or rather a series of overlapping seas, and any disturbance, such as that caused by an important improvement or invention, set going a ripple or wave, which, enlarging its circumference as it moved, spread abroad until it reached the most distant shores of humanity.

In Africa, as elsewhere, we know much more about early cultures than about the men who fashioned and used them. The oldest graves of Egypt have yielded the same type of man as we still find in the valley of the Nile. But if we have not found the actual remains of Palæolithic man in Africa north of the Equator, we have evidence which confirms us in our belief that a very long time has elapsed since the modern type of man appeared in this part of the world. The ancestral stock of this type has given rise to the European on the one hand, and to the negro on the other. At Cairo, we have a people which merge into the Southern European type. If we ascend the valley of the Nile we find by the time we reach Khartoum, which is 1000 miles distant as the aeroplane flies, that we are amongst a people which merge into the negro type; we have crossed the threshold of the real Africa. Between Cairo and Khartoum we find an intermediate series which link the South European to the negro of the Sudan. It is true that there has been much racial intercrossing along the Nile valley, but evolution is also true; these transitional types between Cairo and Khartoum are not the products of hybridity but representative stages of the ancestral stock which has given rise to the types of both Europe and Africa. All the information at our disposal points to the evolution of new races and types as a slow process involving the lapse of a long period of time.

That the tall negro type which is found on the Nile south of Khartoum is also ancient becomes evident from excavations carried out at Gebel Moya, a station situated on an arid range of granite hills between the Blue and White Niles. In 1910, Mr Henry S. Wellcome commenced a series of explorations at Gebel Moya, and discovered a cemetery of prehistoric date. Some of the graves may have been dug in the time of the earlier Egyptian dynasties. In the deeper graves "fossilised" skeletons of a tall negro people were found, belonging to a race not unlike the tall, long-limbed negro tribes which now live along the valley of the White Nile. The remains of those people have been described by Dr Douglas Derry.[1] As in modern negroes of the same region, lip ornaments were worn, and in the women the lower incisor teeth were extracted. The discovery is important in this respect: it shows us that three thousand or four thousand years ago a tall negro type was in existence, and inhabited this part of the Sudan, practising the same bodily mutilations as their modern successors.

The next point in our journey takes us to Tanganyika Territory, formerly known as German East Africa, to the south of Lake Victoria. In 1914, Dr Hans Reck discovered in a stratified deposit at Oldoway, in the northern part of German East Africa, a human skeleton, in the contracted posture, and exhibiting all the features of a typical negro. The stratum in which the skeleton lay—one composed of calcareous sand—contained remains of extinct animals of the Pleistocene period. The antiquity of the skeleton is probably not so great as the stratum in which it lay, for a complete human skeleton laid in a contracted posture signifies a burial, unless the opposite can be proved—or, at least, unless a natural entombment can be rendered probable. The teeth were artificially pointed by having been filed—a custom still prevalent among negro tribes of East Africa. It is very probable that the negro was fully evolved in early Pleistocene

[1] See *Proc. of Seventeenth Internat. Congress of Medicine*, London, 1913, Sec. I.: "Anat. and Embryology," pt. 2, p. 99.

times, but the evidence from Oldoway cannot be accepted as having finally proved this degree of antiquity.[1]

We have finished a cursory survey of what is known concerning ancient man in Africa north of the Equator. In our next chapter we cross the Equator to find the actual remains of Palæolithic man.

[1] See *Illustrated London News*, 4th April 1914.

CHAPTER XIX

ANCIENT MAN IN SOUTH AFRICA

In the previous chapter the reader was conducted to the equatorial region of Uganda and now stands with his face towards the Cape of Good Hope, some 2500 miles distant. We are to enter one of the great *culs-de-sac* of the world in the hope that just such a remote land as lies before us may have sheltered some of the ancient types of man and that he may be found still living in the manner adopted by our forefathers in Europe some fifteen thousand years ago. In this hope we shall not be disappointed.

Before setting out on our quest, however, it may be well to review very briefly some considerations which may serve for our guidance. In Uganda we are well within the negro belt; away to our right lies the wide basin of the Congo, the great cradle in which the purer negro types have become differentiated. The kind of man we are now amongst differs in every feature from the fairer races of Europe, yet their dissimilarity is bridged by an intermediate series which shades from the one type to the other. To explain such a series we have to suppose that both white and black men have been evolved from a common stock—one which must be of great antiquity. Further, we must suppose that these types—negro and European—have been differentiated in the lands where we now find them—the one south of the Sahara, the other to the north of it. From their respective cradle lands these types have extended their distribution, suppressing other types or pushing them into remote corners.

From his cradle land the European has spread abroad; so has the negro. From Uganda an upland route leads southwards, by the great lakes and Rhodesia to the Transvaal and Natal. Along this route wave after wave of the great negro stock has spread, exterminating

FIG. 127.—Sketch map of Southern Africa, showing sites mentioned in the text.

the older inhabitants, save such as sought the desert or the shelter of secluded nooks. We see here one side of the machinery of evolution—that which leads to the spread of new types and the extermination of the old.

We are now to follow the south road from Uganda to Cape Colony in search of such remnants of the old races of South Africa as may have survived the negro conquest. About half-way we cross the Zambesi at Victoria Falls,

and are immediately on the outer fringes of the great Kalahari desert, where there still may be seen a people leading a " Palæolithic " life—the Bushmen. Only some four thousand survive, scattered over an almost rainless country, but one which is scarred with ancient river-courses, showing that this desert, like the Sahara, was once a fertile land. Over this inhospitable land the Bushmen are scattered as tribal groups, living as hunters and trappers, eking out a scanty dietary by the consumption of such creeping things and wild roots as their country affords. They scorn the tame lives led by other men, both black and white. Although some have adopted the black man's wigwam, their real homes are rock-shelters and caves, just as was the case with Europeans of the Aurignacian period. Indeed their culture is Aurignacian ; they shape their stone weapons, fashion necklaces and other ornaments, paint and engrave, and bury their dead in the way that was fashionable in Southern Europe some fifteen thousand years ago. And yet the Bushman never lived in Europe ; he has, as we shall see, the most distinctive features, and no ancient grave in Europe has yielded any trace of his type. No doubt, the Bushman's culture and that of the Aurignacian in Europe came from a common source.

Although the Bushman's manner of living is primitive, yet in build of body and brain he represents a highly specialised type, however ancient or recent this type may prove to be. In a structural sense, he has departed farther from the common simian ancestor than his cousin of Europe. The woolly hair of his scalp, growing in short tufted screws, his thick, everted lips, and his flat, wide nose tell in the plainest terms that he is a branch of the great negro stock. But all of these are human characters—characters never seen in apes—only in that branch of mankind which has its chief home in Africa. The Bushman is of short stature—a dwarf, the average height for men being under 5 feet. Dwarf races are not primitive ; rather the opposite. They are races which have been shaped under the influence of a " Peter Pan "

tendency—a tendency to retain throughout life the features of body and traits of mind which characterise the youths of a race. The Bushman's skull, which can be easily distinguished from that of all other races, will serve to illustrate my meaning, and at the same time help us to interpret the significance of certain features which are to be met with in some of the ancient skulls of South

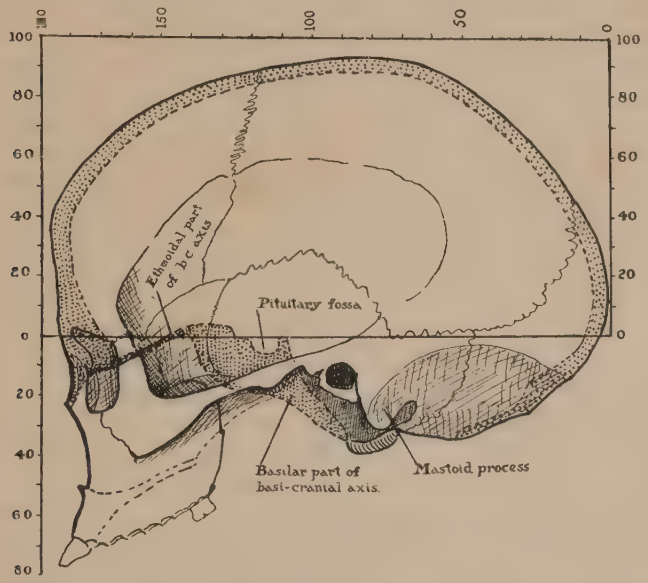

FIG. 128.—The Bushman's skull drawn in profile. The basi-cranial axis and vault are picked out by stippling.

Africa. In fig. 128, a Bushman's skull is drawn in profile; the base of the skull, or basi-cranial axis, on which the vault is set, is there depicted. There are two parts in this axis: a hinder or basilar and an anterior or ethmoidal. In the Bushman's skull the ethmoidal part is usually bent downwards, as is shown in fig. 128. In apes and in primitive races of men it is the opposite: the ethmoidal axis rises above the zero line of the skull (fig. 128, 0, 0). In embryonic stages, however, both of ape and man, the ethmoidal part of the cranial axis is bent down as in fig. 128; it becomes unbent as development proceeds.

In the Bushman, and also in certain other races, this embryonic or youthful feature tends to be retained. One result is to cause the upper part of the forehead to bulge forwards (fig. 128). The small mastoid processes, the slight development of supra-orbital ridges and many other features of the Bushman's skull, may be construed in this manner. So, too, we may explain their yellowish brown skins; the Bushman retains a shade of colouring which the negro baby passes through before birth.

We must presume that all branches of the negro stock have a tendency to give rise to dwarf varieties. In the Congo forests, to the west of Uganda, we find a pygmy people, miniatures of the Congo negro; farther north are the Akkas, akin to the negro of the Sudan; away in the Far East, in the Malay Peninsula, in New Guinea, and the Philippines, where isolated fragments of the negro belt still persist, we find dwarf representations of the taller races of these parts. If this be true, the Bushman should also have an ancestry of normal stature.

If we have not found the actual full-statured ancestor of the Bushman, we are familiar with its modern representative. When the Dutch established themselves at the Cape in 1652, they found the surrounding country occupied by a pastoral people whom they named Hottentots. In colour of skin, in form of ear, in texture of hair, in facial features, and in shape of skull, Hottentots bear a close resemblance to the untamable Bushman. Only they are "grown-ups"; the average stature of the men is 5 feet 5 inches; they become dull and sluggish as they reach manhood, whereas the Bushman retains the activity, playfulness, and brightness of boyhood. The Hottentot women had even a greater tendency than the Bushwomen to accumulate fat on certain parts of their bodies. We may conclude, then, that Bushman and Hottentot come of a common stock, but of the two we must suppose that the Hottentot most resembles the common ancestor. Further, we have every reason to believe that Hottentot and Bushman have been evolved in Southern Africa.

The Hottentot race, the real natives of the Cape, have

been squeezed almost out of existence. They were caught between two aggressive stocks—the white, or European, advancing from the south, and the Black, or Bantu, from the north. Although there may still be eighty thousand people who have Hottentot blood in their veins, they are bastardised representatives of the type. The fate which is overtaking the Hottentots seems to have befallen a race near akin to them and also to the Bushmen—the Strandloopers. We know of them only by their kitchen-middens, and their cliff-shelters which abound along the coast from Cape Town to Port Elizabeth (fig. 127). From a study of their skulls and skeletons, Dr F. C. Shrubsall [1] concludes that the Strandloopers were of the same stock or type as the Bushmen and Hottentots but differed in detail from both of these. In size of head many of them reached European dimensions; they were large-headed, and their faces, particularly their noses, were less negroid than either of the living types. Their civilisation was akin to that of the ancient cave-dwellers of Europe.

The culture of the Bushman is Aurignacian, but there are very clear traces of still older methods of working stone implements in South Africa. So long ago as 1860, Mr T. H. Bowker [2] observed that the gravels of Cape Colony, like the river terraces of England, contained palæoliths. Mr Bowker's early observations illustrate in a striking manner the rapidity with which news of a discovery spreads round the world. It was only in the previous year, 1859, that Sir John Evans, having visited Boucher de Perthes at Abbeville, returned to England to find that the gravel terraces of the Thames valley, like those of the Somme, contained the handiwork of ancient man. We know now that South Africa almost rivals Europe in the richness of its ancient stone cultures. We have already traced the ancient cultures of Europe, from pre-Chellean downwards, as far south as Uganda;

[1] Dr F. C. Shrubsall, *Annals of South African Museum*, 1907, vol. v. p. 227; *ibid.*, 1911, vol. viii. p. 227.

[2] See E. L. Layard, "South African Stone Implements," *Journ. Anthrop. Instit.*, 1872, vol. i.

investigations made in recent years show that these ancient cultures have representations throughout the whole of South Africa. The high terrace gravels of the Zambesi, at Victoria Falls, are rich in palæoliths; in the ancient deposits of the Monapo river, to the north of the Zambesi, Mr E. J. Wayland discovered the same series of ancient implements. They have been found in Swaziland and in the gravels throughout the whole watershed of the Orange river. These gravels contain remains of extinct species of buffalo, horse, gnu, and antelope.[1] Mr Reginald A. Smith[2] of the British Museum has studied the type of implements yielded by South African deposits; all the older types of Europe are represented, but, as the late Dr L. Péringuey[3] was wont to insist, the Chellean, Acheulean, and Mousterian cultures are not sharply divided into separate time periods as in Europe. Stone implements are so abundant in the gravels of South Africa that Major E. R. Collins was able to gather an extensive collection from trenches dug during the Boer War.

The man who has best summarised our knowledge of South Africa in prehistoric times—the late Mr J. P. Johnson, a young mining engineer—deserves more than a passing mention. In his youth he was an ardent student of the implementiferous gravels of England, and in 1902, when only twenty-two years of age, had to seek a new home in South Africa on account of his health. There, in the intervals of business, he devoted himself to a study of the traces of ancient man in South Africa, giving the world the fruits of his study in two excellent books.[4] Mr Johnson perceived that in South Africa, as in Europe,

[1] Dr R. Broom, *Annals of the South African Museum*, 1920, vol. xii. pt. i.

[2] Mr Reginald A. Smith, *Man*, 1919, vol. xix. p. 100.

[3] Dr L. Péringuey, *Annals of the South African Museum*, 1911, vol. viii. Dr Péringuey died on 20th February 1924. His publication will be found in the *Annals of the South African Museum*, with which he was connected for forty years, ultimately becoming its director.

[4] *The Stone Implements of South Africa*, 1908 (2nd edition). *The Prehistoric Periods of South Africa*, 1912 (2nd edition).

three great periods of stone culture had to be recognised—Eolithic, Palæolithic, and Recent.

To illustrate the conditions under which ancient stone implements are found in South Africa, I have reproduced in fig. 129 a section of valley gravels taken from a recent paper by Mr Neville Jones.[1] The scene of Mr Jones' investigation is indicated in fig. 127; it lies north of Kimberley, near the railroad to Bulawayo, which here skirts the eastern fringe of the Kalahari desert. Down this fringe of the desert comes the bed of the Harts river, to join that of the Vaal. Mr Jones found that a tributary

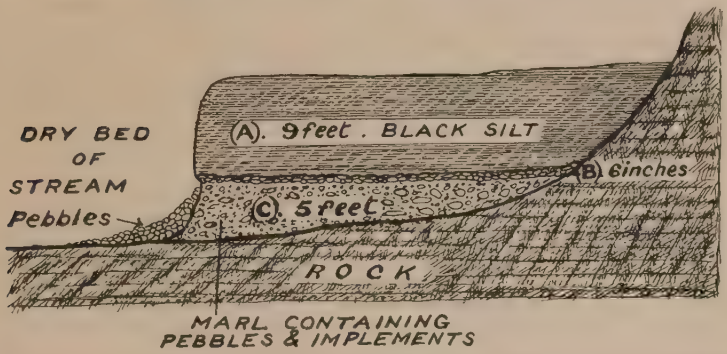

FIG. 129.—A section of the implementiferous gravels exposed on the bank of a tributary of the Harts river at Taungs. (After Mr Neville Jones.)

of the Harts river, at Taungs (fig. 127), had cut a channel in, and thus laid open, a valley deposit of gravel. This gravel deposit is clearly the bed of an ancient stream. The deposit, as shown in fig. 129, consists of (A) 9 feet of black silt, the most recent deposit; above the silt Bushmen's implements are found. Under the silt comes a thin stratum (B), only 6 inches in thickness, which contains sharp-edged implements of lydianite and shale, shaped in the Mousterian style. Then upon the bed-rock comes the oldest valley deposit (C), a marl—a mixture of carbonate of lime, sand, and clay—in which pebbles and implements are embedded. The implements, of quartzite

[1] "Implement-bearing Deposits of Taungs and Tiger Kloof," *Journ. Roy. Anthrop. Instit.*, 1920, vol. l. p. 412.

and other hard stone—for flints do not occur in South Africa—were worked in the Acheulean manner. These implements were not sharp-edged; it was clear from their appearance that they had been swept by floods from old land surfaces and rolled in the bed of the ancient stream. In a still older deposit of the Harts river Mr Jones found implements which answer to the Chellean and pre-Chellean types of Europe. Here, then, is a remarkable state of affairs in the pre-history of man. Although 6000 miles of jungle, desert, and sea lie between the sites we are now dealing with and those which we visited near Ipswich, yet we meet with the same order of stone cultures. We must infer that from pre-Chellean days onwards both South Africans and East Anglians were subject to the various cultural waves which slowly crept over the world time after time.

Having thus passed in brief review what is known of the ancient stone cultures of South Africa, we now turn to see what can be learned concerning the men who used them. The implementiferous gravels of the Harts river, which we have been examining at Taungs, lie beyond the western frontier of the Transvaal. The scene of the first discovery of fossil man in South Africa lies in the Transvaal, 150 miles to the east of Taungs, near Boskop, in the Potchefstroom district, to the north of the Vaal (fig. 127). A river, the Mooi river, runs southwards to the Vaal; on the eastern side of the Mooi Mr J. B. Botha had built his farmhouse, separated from the stream by the breadth of a field. In the summer of 1913 a drain was being dug across this field; the workmen had to cut through (1) a black soil, a foot in thickness; then (2) a subsoil, 4 feet 3 inches thick, under which came (3) a stratum of "lateritic breccia," consisting of "small pebbles, with pellets of chert and sandstone, set in a ferruginous and occasionally siliceous matrix." The bottom of the drain reached the deeper part of the subsoil in which irregular lumps of the breccia were scattered. When the drain had been carried to about 80 yards from the Mooi, strange-looking bones were found in the deeper levels of

the subsoil, about 4 feet 6 inches below the surface of the field and about 12 feet above the bed of the adjacent river. There arose a discussion between Mr Botha and a neighbour as to whether or not the bones were human. They were taken to Port Elizabeth, over 500 miles away, where Mr F. W. Fitzsimons, Director of the Museum there, not only recognised their humanity, but perceived that at last fossil man had been discovered in South Africa. He at once made the long journey to Mr Botha's farm, examining and exploring the site of the discovery. Later he was joined by colleagues from the South African Museum at Cape Town, and a further search being made, fragments of the leg and arm bones were recovered.

It was under such circumstances that the Boskop man made his appearance in the archæological world. He is represented by a remarkable skull-cap, a right temporal bone (fig. 130), a large part of the left half of the lower jaw, together with fragments of the bones of the forearm, thigh, and leg. All are deeply mineralised, and all clearly belong to one individual. We may feel certain we are dealing, not with a natural inhumation, but an ancient burial. The remains were conveyed to the South African Museum, Cape Town, where they were examined and described by Mr S. H. Haughton.[1] An endocranial or "brain" cast of the skull was submitted to Professor Elliot Smith for a report.[2] Afterwards the parts of the skull were brought to England to be examined by Mr W. P. Pycraft, of the Natural History Museum, South Kensington, when they were exhibited at the Royal Society. The description given here is founded on observations made on the skull when it was in England, the drawings being made from casts of the skull-fragments supplied to the Museum of the Royal College of Surgeons of England.

1 "Preliminary Note on the Ancient Skull-remains from the Transvaal, by S. H. Haughton, Assistant Director of the South African Museum, with Notes appended on the Fragments of the Limb-bones by R. B. Thomson, and Fragments of Stone by L. Péringuey, Director of the South African Museum," *Trans. Roy. Soc. South Africa*, 1917, vol. vi. p. 1.

2 *Proc. Manchester Literary and Philosophical Soc.*, 23rd January 1917.

Before passing in review the singularities of the Boskop man, it may be well to see if any light can be thrown on his antiquity. The mineralised condition of the bones does not signify much ; they were impregnated with iron and silica from the stratum in which they were embedded. The few rudely worked stones from the site of burial may prove helpful. At first Dr Péringuey doubted if they had been shaped by man ; later he thought they might be regarded as showing crude Mousterian workmanship. We cannot be far wrong in comparing the strata of Mr Botha's field to the valley deposits described by Mr Neville Jones at Taungs. On the surface of the basal marl or conglomerate at Taungs there was a thin stratum which contained Mousterian implements. The Boskop skeleton lay at a corresponding level above the stratum of "lateritic breccia," the skull itself having been encased in a mass of this breccia. Provisionally the Boskop man may be assigned to the period of Mousterian culture in South Africa, which in all likelihood was much later in date than the corresponding culture in Europe. I expect future discoveries to prove that the Boskop man was contemporary with late Palæolithic man in Europe.

What kind of race or breed does the Boskop man represent ? I shall give here my conclusions, stating my reasons briefly as I proceed with the description of the remains. In the first place there can be no doubt he falls within the modern type—the type or species (*Homo sapiens*) which embraces all living varieties or races of mankind. He is certainly not a separate or new species.[1] When I came to fitting the temporal bone to the calvaria (see fig. 130), and tracing the cranial likenesses of the Boskop man, I found that the skulls of Bushmen and Hottentots gave me more help than skulls of other races. I have no doubt, as will be realised by the reader further on, that had there been skulls of Strandloopers at my disposal, I should have found them of even greater

[1] Dr Robert Broom regards the Boskop man as a new species which he has named *Homo capensis* (*Anthrop. Papers, Amer. Mus. Nat. Hist.*, 1918, vol. xxiii. pt. ii.).

assistance. The conclusion I have reached is that the Boskop man should be regarded as an ancient member of the stock now represented in South Africa by Bushman and Hottentot. There are reasons which lead us to regard South Africa as the homeland—the evolutionary

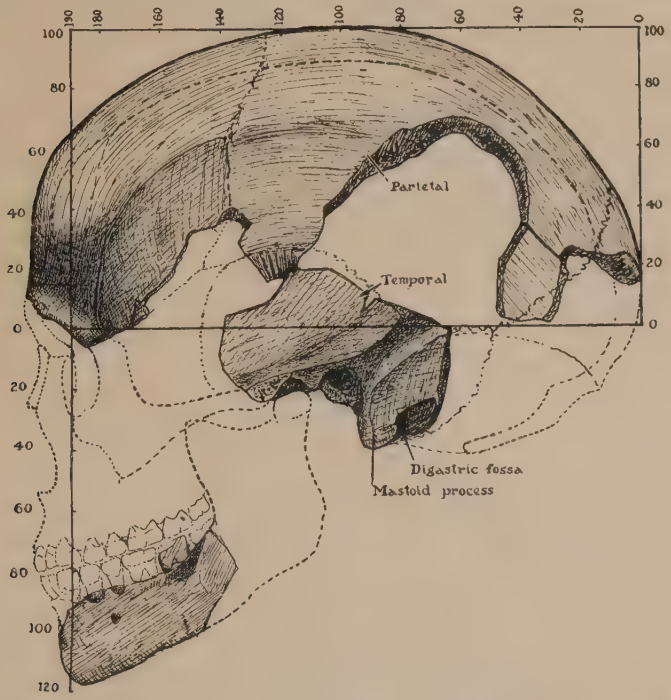

FIG. 130.—The Boskop skull reconstructed and shown in profile. The sides of the skull, except the lower jaw, have been reversed to make the face look to the left and make this diagram comparable with others given in this work. The skull has been placed within the framework of lines which fits the skull of an average Englishman.

cradle—of all members of the Boskop type. Further, we must look upon the negro type and the Boskop type as divergent branches which have arisen from a common stock.

The most remarkable feature of the Boskop man is the size of that part of his skull which contains the brain. In fig. 130, the skull has been fitted into the frame of lines which serve to bound the skull of an average Englishman.

As regards length, the skull far exceeds that of the average Englishman. In place of being 190 mm. it is 205 mm. in length. On the other hand, as regards height of vault, it just reaches the 100-mm. level (see fig. 130). The height of the vault above the ear-holes is 115 mm., the same distance as in the average English skull. As may be seen from fig. 128 (p. 359), the Bushman's skull falls far short of the standard frame, both in length and height, but in proportion of height to length the Boskop skull agrees with the Bushman's. The Boskop man had a very wide as well as a long head. In fig. 131, a vertex view of the skull is drawn and fitted within the standard frame which serves for ancient European skulls. The Boskop specimen far exceeds the standard width, being 154 mm. The Bushman's skull (fig. 131), although presenting a similar shape, falls far short of the standard width. If we apply to these dimensions of the skull—length, width, and height—the formula for determining its brain capacity [1] we find that the measure is large, 1630 c.c.—150 c.c. above that of the average Englishman. Direct measurement will probably show its capacity to be greater—about 1700 c.c. It is the irony of fate that the stock of the big-brained Boskop man should become extinct while his small-brained relative, the Bushman, should still survive. The average cranial capacity of the Bushman is only 1300 c.c., of the Hottentot 1380 c.c., but in the extinct Strandloopers, Dr Shrubsall found several individuals with capacities well above 1500 c.c. A big brain is only one factor in the survival of a race; its significance we shall discuss later.[2]

The width of the Boskop skull is 75 per cent. of its length, a proportion common in the skulls of Bushmen, Hottentots, and Strandloopers. The essential nature of the Boskop race was manifested in his forehead. We have already discussed the bending of the basi-cranial axis in the Bushman (p. 359) and the forward prominence of his upper forehead. Similar features are to be recognised in the Boskop skull and forehead. There is also

[1] See p. 596.

[2] See Chapters IV, XXXII, pp. 75, 606.

another Bushman feature in the Boskop forehead. It is markedly drawn in or constricted across the narrowest part of the brow, between the frontal bosses above and the supra-orbital ridges below. Below this constriction the Bushman's supra-orbital processes project prominently at his temples; the Boskop man had the same conformation of parts. At its narrowest his forehead measured 102 mm. (98 mm. is an average width in Englishmen) while its width at the supra-orbital processes was 114 mm.

Another feature of the Boskop skull is its mastoid processes (fig. 130), which afford attachment to muscles which move the head. They are of a nipple shape, leaving exposed behind a wide area of the digastric fossa. In the skulls of Bushmen, Hottentots, and Strandloopers we see approaches to this form. We also see in them, as in the Boskop skull, a deep groove, above and behind the ear, lying between a ridge for the temporal muscle above and another below, for giving attachment to muscles of the neck. All these points are mentioned to bring out the close relationship of the Boskop type to that of the Hottentot-Bushman stock.

Fortunately we have a large fragment of the lower jaw to tell us something of the features of the Boskop face. In strength and markings this fragment presents a slight exaggeration of Bushman qualities. In shape and size the teeth and palate must have been in close agreement with those of the larger-sized Bushmen. But there would have been this difference. The Bushman's skull is small; to attain adequate size of palate the upper jaw of the Bushman has to project well in front of the nasal opening; he has what is known as "subnasal prognathism" (fig. 128). In the Boskop skull the forehead and upper part of the face project so far forwards as to cover, or come into line with, the projection of teeth and jaws. As represented in fig. 130, he must have been straight-faced (orthognathous) as are most Europeans. Dr Shrubsall observed that in many skulls of Strandloopers there was a tendency to orthognathism. This

character, like big-brainedness, we scarcely expected to meet with in the ancient inhabitants of South Africa.

One other feature of the Boskop skull—one which I have come across only in the skulls of African negroes—deserves our attention. As may be seen from fig. 130, the parietal bone is very thick, measuring in its middle part—at the site of the parietal eminence—13 to 14 mm.

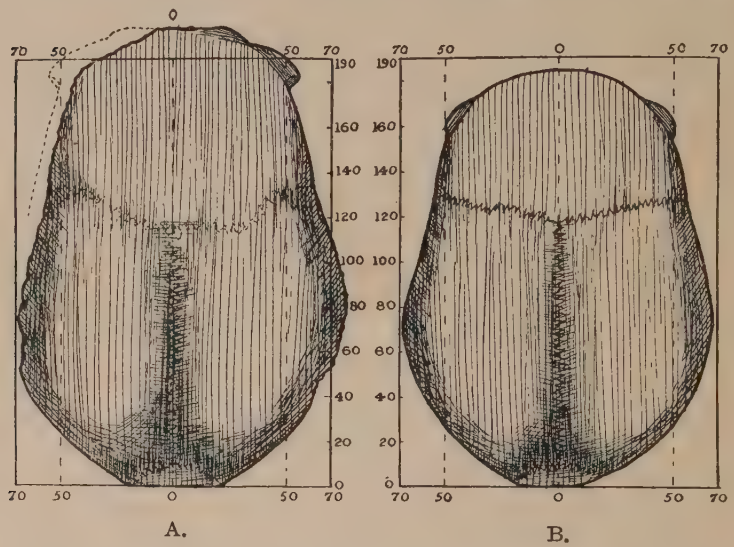

FIG. 131.—A. Vertex view of the Boskop skull. B. Corresponding view of a Bushman's skull. Both are represented at right angles to the plane used in fig. 130.

But although so thick in its central part, it tapers off to half this thickness towards its edges or sutures. It is really bun-shaped, the extra thickness of bone having been laid down on the more central parts of its outer surface. Hence it comes about that along the mid-line of the roof of the skull, between the bun-like eminences of the two parietals, there is a wide, well-marked groove or hollow. This kind of thickening of the parietal bones is essentially of a pathological nature, for there is evidence which leads us to suppose that such changes are a result of wrong feeding during youth. A diet which is lacking

in certain substances (vitamins) will produce such states. In any case, the negro race seems more susceptible to this form of cranial deformation than other races. The Boskop skull also shows a peculiar anomaly of the middle ear which will be noted more fully when we come to deal with Rhodesian man.

As to the stature and strength of the Boskop man we have only fragments of the limb bones to guide us. These fragments proclaim most emphatically that he was not a pygmy or dwarf, such as the later Strandloopers were, but robust and at least as tall as the stronger Hottentots—5 feet 6 inches or thereabouts.

In 1921, eight years after the discovery at Boskop, Mr F. W. Fitzsimons, Director of the Museum, Port Elizabeth, succeeded in throwing further light on the ancient natives of South Africa. About a hundred miles to the west of Port Elizabeth the cliffs of T'zitzikama (fig. 127) present a rugged face to the sea, providing just the caves and rock-shelters which served ancient man as dwelling-places. All along the coast are to be found the kitchen-middens of the Strandloopers. Some of these shell and refuse heaps are of immense size, one measuring 600 feet in length, 120 feet in width, and 12 feet in depth. It was to this locality that Mr Fitzsimons came in 1921, bringing his son with him to aid in his archæological investigations. He selected for exploration a rock-shelter high up on the cliff face.[1] The results of his labours are epitomised in fig. 132. The first or uppermost stratum (A), 6 feet in depth, contained nothing of interest—it had accumulated after the rock-shelter had been abandoned as a dwelling-place. In the next stratum (B), some 7 feet in thickness, numerous Strandlooper burials were encountered amidst remains of fireplaces, broken pottery, implements and ornaments in stone and bone. Then came the third stratum (C), over 6 feet in thickness; it was while removing this stratum and working at a depth of 15 feet below the original floor of the

[1] An account of these explorations, very fully illustrated, was published in the *Illustrated London News*, 21st December 1921.

shelter that Mr Fitzsimons came across graves containing remains which differed from those he had met with in the stratum above (B). Unfortunately the bones in the lower stratum were imperfectly preserved. The graves had been partly protected by slabs of stone, some of which had been rudely engraved with human figures. There were lumps of red ochre, necklaces of shell and bone;

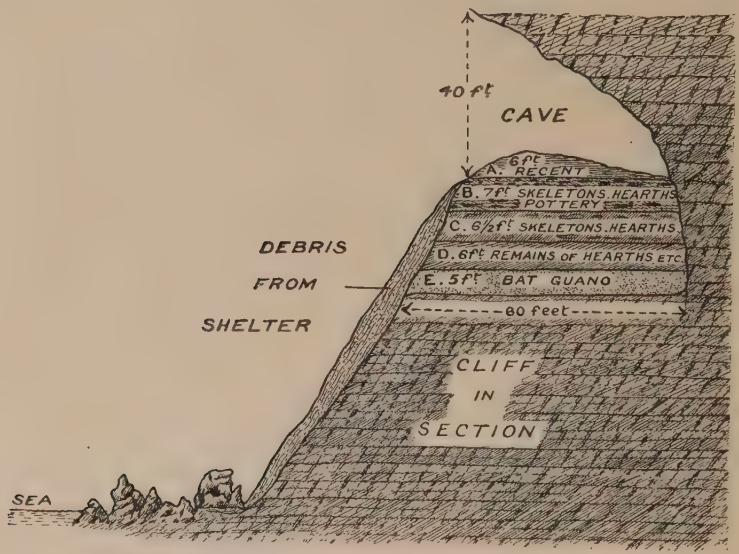

FIG. 132.—Diagram of the strata encountered by Mr F. W. Fitzsimons in the floor of the rock-shelter at T'zitzikama. (After a drawing by Mr Fitzsimons.)

there were tools worked in stone and in bone. Then, in a still deeper stratum (D), also about 6 feet in thickness, there were traces of burials and hearths, but the bones had almost mouldered away into dust.

The human bones from the deeper stratum (C) were entrusted for investigation to the young and able Professor of Anatomy in the University of the Witwatersrand, Johannesburg, Dr Raymond A. Dart, who has published a preliminary account of them.[1] A brief examination was

[1] "Boskop Remains from the South-east African Coast," *Nature*, 1923, vol. cxii. p. 623.

sufficient to convince him that the remains unearthed by Mr Fitzsimons in the deeper stratum at T'zitzikama were those of members of the Boskop race or breed. Yet T'zitzikama is over 500 miles distant from Boskop as the crow flies. The Boskop type must have been spread over a wide area.

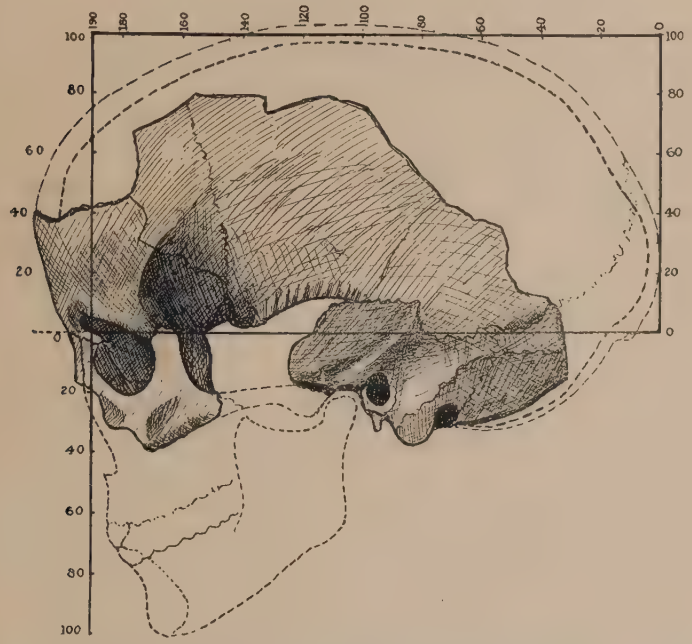

FIG. 133.—The T'zitzikama skull in profile. (Drawn from a photograph of a reconstruction made by Professor Dart.)

Altogether Mr Fitzsimons found the remains of twenty-three individuals in the strata of the rock-shelter, five of these being obtained from the deeper stratum (C). From the fragmentary remains found in the deeper stratum Professor Dart was able to reconstruct a skull which is represented in fig. 133. It is probably the skull of a woman and its dimensions are truly remarkable, exceeding even those of the original Boskop specimen. The forehead is seen to project 20 mm. beyond the standard

frame—the total length of the skull, as estimated by Professor Dart, being 210 mm. Its vault also rises a little above the standard frame (fig. 133), its height above the ear passages being 117 mm. Like the Bushman's skull, the vault is low in comparison with its total width. This skull also possesses in a very high degree a character which we have already noted in the skulls of Bushmen, namely, the bending of the basi-cranial axis and the forward projection of the upper part of the forehead (p. 359). Further, the mastoid process and the ridges and grooves above and behind the ear are modelled as in the Boskop skull. The width of the skull is 150 mm., being 71 per cent. of the length; it is long and relatively narrow in comparison with its length. The femur, which is believed to belong to the same individual as the skull, is 461 mm. long; the T'zitzikama woman must have had a stature of 5 feet 6 inches. Her lumbar curvature, as in the Bushwoman, was well marked.

If we apply to the dimensions of this skull the formula[1] used for estimating the volume of the brain, we obtain a cranial capacity of 1600 cubic centimetres. Professor Dart was able to construct a model of the brain cavity, and this model had a volume of 1750 c.c. It is possible that the Lee-Pearson formula may underestimate the capacity of large skulls. In any case, the Boskop people had brains, which, in point of volume, far exceeded the average given to modern Europeans. The two sides of the brain were not alike; the frontal pole predominated on the right, the occiput on the left; such asymmetry indicates a high degree of specialisation in the development of the brain. Yet Professor Dart observed certain primitive features on the model of the brain cavity. As in the brains of primitive races, the insular lobe[2] was imperfectly covered, and the occipital lobe was marked by a *sulcus lunatus*, sometimes spoken of as the simian fissure.

Here, then, in South Africa, is being revealed an unexpected chapter in the history of mankind. From the

[1] See p. 596. [2] See p. 611.

evidence afforded by gravel deposits we see that this part of the world has been the home of man from remote times, how remote we cannot yet tell. Amongst its ancient inhabitants there has been a race which in volume of brain outrivals any people of Europe, ancient or modern, and yet this big-brained race has disappeared, while small-brained collateral descendants of the same stock have survived. Nay, these ancient Boskop people resembled Europeans, not only in volume of brain but in their straight-facedness (orthognathism) and in some other features. This may tempt us into supposing that they may have originated on the European side of the Sahara and wandered southwards, but two considerations will keep us from adopting such an hypothesis. The first is the close structural affinity of the Boskop type to that of Hottentot and Bushman; all three must be products of a common stock. The second consideration is that the essential features of the African negro type—with which the Boskop type must be affiliated—have made their appearance—have been evolved or differentiated—in comparatively recent times. As we trace the ancestry of the African negro backwards in time we shall find him approaching the common ancestor from which his and the European type were evolved. Of living peoples the nearest approach to this ancestral type is represented by the aborigines of Australia. We must not be surprised, then, to find in South Africa during early times a race which is rather less negro and more European than the natives who now live in Africa south of the Sahara.

There is one other matter which deserves the attention of the reader before this chapter is brought to an end. Between the rock-shelter at T'zitzikama and the caves at Grimaldi, there intervene the whole length of the continent of Africa and the width of the Mediterranean, and yet at both places we find ancient peoples leading lives which are almost identical. They buried their dead in the floor of their dwelling-place, in the same contracted posture, in the same kind of grave, with

the same ceremonies, laying with the dead the same kind of ornament and tool. Yet they were peoples of diverse racial origin. At Grimaldi, cave life and Palæolithic culture came to an end at the close of the Pleistocene period, whereas in South Africa they have persisted into our own time.

END OF VOL. I.

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